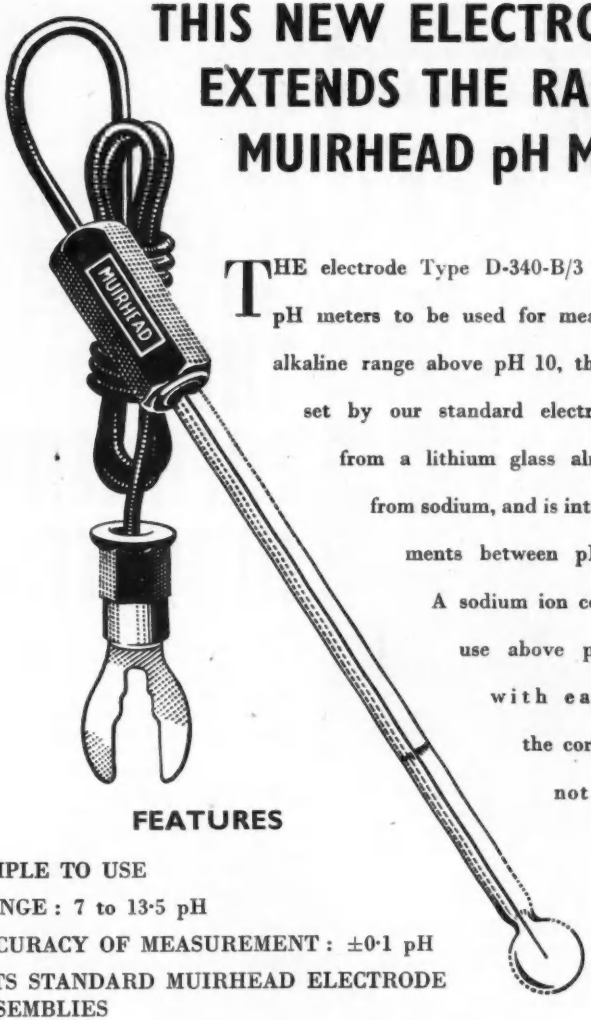
The Chemical Age

VOL LXVI 26 JANUARY 1952 No 1698

THIS NEW ELECTRODE EXTENDS THE RANGE OF MUIRHEAD pH METERS



THE electrode Type D-340-B/3 enables Muirhead pH meters to be used for measurements in the alkaline range above pH 10, the limit previously set by our standard electrode. It is made from a lithium glass almost entirely free from sodium, and is intended for measurements between pH 7 and pH 13·5. A sodium ion correction curve for use above pH 12 is supplied with each electrode; the correction factor does not exceed 0·3 pH.

FEATURES

SIMPLE TO USE
RANGE : 7 to 13·5 pH
ACCURACY OF MEASUREMENT : ±0·1 pH
FITS STANDARD MUIRHEAD ELECTRODE ASSEMBLIES

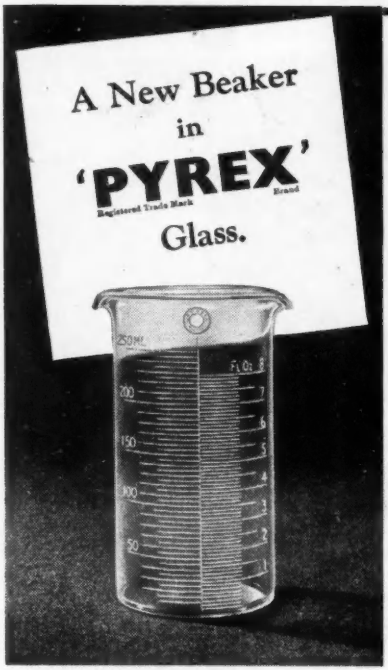
MUIRHEAD & Co., LTD.
PRECISION ELECTRICAL INSTRUMENT MAKERS
BECKENHAM · KENT · ENGLAND
Phone: BEC 0041 Telegrams & Cables: MUIRHEADS ELMERS-END

PRECISION MUIRHEAD ELECTRICAL INSTRUMENTS

35C

A

INDEX TO ADVERTISERS IN THIS ISSUE



'PYREX' Brand Graduated Glassware is supplied only through Laboratory Furnishers, but illustrated catalogue and two free copies of our Chemist's Notebook will be sent direct on application to us.

IN all work which entails the precise measuring of liquids, you can place the utmost reliance in 'PYREX' Brand Graduated Glassware. The accuracy with which calibrations and graduations are made is an assurance of correct volumetric capacity.

. . .

For everyday laboratory work 'PYREX' Glassware is graduated to N.P.L. Class B Standard, but for more meticulous analysis, or intricate research work, N.P.L. Class A can be supplied at a reasonable extra cost.

. . .

Our photograph shows a graduated double-spouted Beaker with double-scale reading. registering up to 250 mls. and 8 fluid ounces.

. . .

This Beaker is one of a series of Graduated Beakers which are a new addition to our range of Laboratory Glassware and carries with it the same guarantee of quality and accuracy as all other 'PYREX' Glassware. Its sturdy strength, made possibe by the low coefficient of expansion of $3{\cdot}2 \times 10^{-6}$ per degree C, keeps replacement costs down to a percentage far less than that of ordinary glass.

. . .

That's why 'PYREX' Glass is so economical.

USE THIS COUPON.

To Messrs. James A. Jobling & Co. Ltd.

Please send us illustrated catalogue of 'PYREX' Brand Laboratory and Scientific Glassware, and two copies of your Chemist's Notebook as above.

Name .....

Address .....

.....

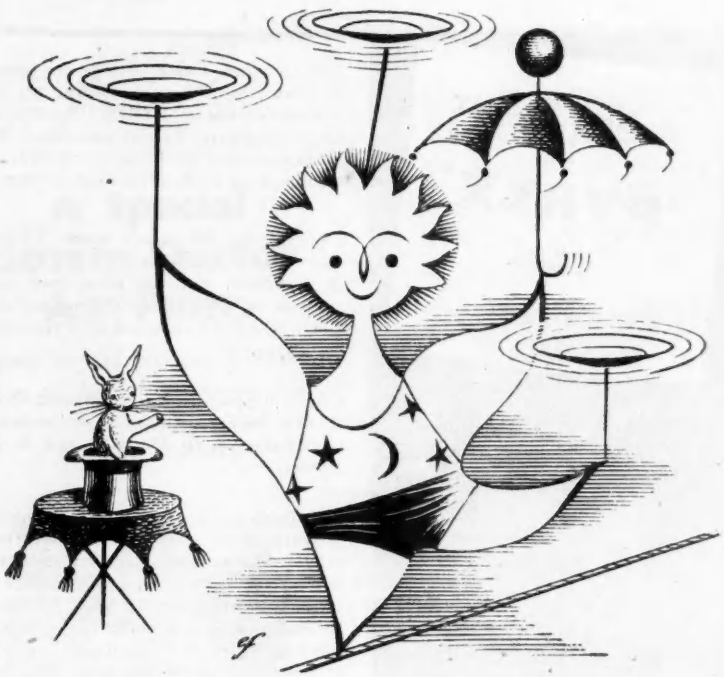
'PYREX'

Regd. Trade Mark BRAND

Laboratory and Scientific Glassware

JAMES A. JOBLING & CO. LTD.,
Wear Glass Works, SUNDERLAND.

G84D



I'VE GOT AMAZING SELF-CONTROL! says Mr. Therm

When you call in Mr. Therm to solve your fuel problems, you get more than just a very willing worker. You get one that is capable of self-adjustment and rigid control of fuel consumption. You can cheerfully set the controls and leave gas-heated equipment to get on with the job *by itself*, for as long as you like. There are other advantages too, of course: cleanliness, flexibility, rapid heating from cold and high efficiency. That is why Mr. Therm and his gas equipment are valued members of almost every industry's productive staff.

Mr. Therm is in the pink

. . . and in a lot of other colours, too! He's got the job of heating the battery of reaction vessels — each of 220 gallons capacity — used in the production of aniline dye at the works of Williams (Hounslow) Ltd. Town gas is used throughout for heating. The specially designed internally insulated housings hold cast-iron pans which are enamelled inside, and fitted with belt-driven agitating mechanism.

MR. THERM BURNS TO SERVE YOU THE GAS COUNCIL · 1 GROSVENOR PLACE · LONDON · SW1

The
Chemical Age

Established 1919

The Weekly Journal of Chemical Engineering and Industrial Chemistry

BOUVERIE HOUSE 154 FLEET STREET LONDON E.C.4
Telegrams: ALLANGAS FLEET LONDON · Telephone: CENTRAL 3212 (26 lines)

Volume LXVI 26 January 1952 Number 1698

Chemistry—O.H.M.S.

IT is easy to assume that the major official efforts in chemical analysis and investigation are those of the DSIR and of chemical departments attached to specific Ministries. The huge task of analytical control together with advisory work for Whitehall that is conducted by the Department of the Government Chemist is apt to be forgotten by those who do not actually come into contact with it. The Report for the year ending 31 March, 1951, has recently been issued (H.M.S.O., pp. 28, 1s.) and in these days when so many chemists must become particularisers and specialists its diversity of chemical effort and function makes pleasant reading. The main regret, perhaps the only regret, a chemically minded reader of the Report will have is that it is so bare a summary of the Department's various activities.

Revenue requirements are not unnaturally producing more work than ever for the Government's chemists; the number of samples rose last year by 15 per cent. Every budget would seem to bring new tasks for the analyst. Even where no changes in customs duties occur, new types of product may create problems of classification. Thus, the rates of duty for imported fresh fruits and preserved fruits vary, but the expanding use of freezing as a method of preservation has produced a new problem for analysis—to distinguish between fruit that is, in fact, fresh and fruit that has been preserved by freezing and thawed out before actual importation. Such a test of distinction has been developed during the year, based upon the fact that fresh fruit respires, but dead fruit does not. Tests have had to be devised for new sweetening chemicals like P.4000 and cyclamate sodium for the duties levied upon saccharin and dulcin falls also upon substances 'of a like nature and use.'

If Chancellors of the Exchequer produce work for the Government Chemist, so do barrow-boys; and it is indeed a sign that this new occupational term has passed with some permanence into our language that it is used, albeit between cautious inverted commas, in the text of this brief Report. The widespread sale of types of confectionery off the ration led to the examination of over 700 samples to determine whether, in fact, the ingredients used called for the surrender of sweet coupons. Legal proceedings against barrow-boys followed in

many cases. It seems almost an unfair loading of the scales against a new profession and there may be perhaps quite an opening for a consultant chemist if the barrow-boys get together and form some collective association.

Food rationing creates another demand for the Department's sampling and analytical services. A change in the Sugar Confectionery Order of 1951 provided a new definition of 'sugar' so far as rationing liability is concerned; not only the well-known sugars but any starch conversion product capable of reducing Fehling's solution was raised to the point-requiring class. (How many of us knew that a chemist of 1849 was named in a current British rationing order?) The annual changes in the permissible content of the sausage, including that of both meat and milk powder, calls for similar flexibility from the Government's Chemists.

There is a welcome indication that the Ministry of Health is keeping an eye on the development of water fluoridisation as a means of reducing dental caries; every sample of water now analysed by the Government Chemist's Department has its fluoride content determined and a steady flow of information is thus passed to the Ministry of Health. The National Health Service Act also keeps the Department busy, for the Government Chemist is the Referee when analysts first called in through local executive committees disagree.

At a time when economy in official expenditure is desirable and frequently called for, it is important to note that the unabating flow of legislation, whether for rationing, tax-levying, or definition, steadily enlarges the work and duties of the Department. Yet the Report points out that no important addition to the accommodation has been made and work is still seriously hampered by restricted space and scattering. The need for a large new building is stated to be pressing. Here there would seem to be one more case for liberating a branch of official or state science from any general economy or retrenchment that may fall upon government services as a whole. Even the acceptance of a static position will be unwise. It was a costly mistake in the early 'thirties to include scientific establishments in the general list for 'cutting down.' A scientific service must expand or it drops backward and behind. No future economy wave should add further delay to the fulfilment of plans to provide the Government Chemist's Department with adequate facilities. Admittedly the volume of research is limited though many specialised advisory services are performed for various Ministries; but the total research value of a primarily analytical organisation can hardly be fully measured. It is an 'invisible asset' of the Department of the Government Chemist.

On Other Pages

The annual subscription to THE CHEMICAL AGE is 35s. Single copies, 9d.; post paid, 1s.; SCOTTISH OFFICE: 116 Hope Street, Glasgow (Central 3954/5). MIDLANDS OFFICE: Daimler House, Paradise Street, Birmingham (Midland 0784-5). THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers, Limited.

Notes & Comments

Football Folly

RELATIONS between employers and employees in the chemical industry and allied trades have over a period of years earned a high repute for their excellence, while the number of chemical industrial disputes has long retained its position among the lowest recorded in the *Ministry of Labour Gazette*. But to be pleasant there is no need for relations between employer and employee to be lax, and indeed discipline, although the word is apt to be regarded with suspicion in these days, is as essential in the factory as it is in the home or the army. Two firms—Cannon Iron Foundries, Ltd., at Bilston, Staffs, and Marston-Excelsior, Ltd., Wolverhampton (a branch of Imperial Chemical Industries, Ltd.)—recently took action against employees who, without permission, took time off to attend a football match. The men are since reported to have apologised to the management, but the firms are to be commended on taking a stand which it is hoped may act as a deterrent to further folly of this nature. The action of the workers was undeniably a deliberate attempt to defy authority and immediate action was necessary. Realisation of the consequence of such absenteeism not only to their own firm but to the chemical industry and the country, if allowed to spread, must be brought home to those workpeople who still seem to be unaware of this nation's dangerous plight. Fortunately they are a very small minority in the chemical industry.

Broadcast Science

INTEREST in scientific development has probably never been so general as it is today. Even the children's papers of the 'strip-cartoon' type glibly tell of adventures concerned with jet propulsion, nuclear fission and strange and wonderful inventions, while more or less informative articles for adults appear in the 'popular' Press. While a desire for information is excellent and to be encouraged, it is important that any attempt to satisfy it should, as far as possible, be reliable and responsible. This seems to be recognised by the BBC, which over a period of years now, has run a series of informative talks on scientific matters. Under the title of 'Look Ahead' a new weekly programme of four talks will begin on 4 February, edited by Professor S. Zuckerman of Birmingham University and produced by Mr. Robin Whitworth.

Farm Methane

A FAIRLY new and certainly practical aspect of agricultural chemistry has been described in the current issue of the Ministry of Agriculture's Journal (1952, **58**, 10, 487). This is the production by silo-fermentation of methane from farm wastes, particularly from cattle-house litter. The methane gas, compressed at 5,000 lb. per sq. inch, becomes a tractor fuel of which 1.33 or 2 gallons are equivalent to a single gallon of petrol. The different ratio depends upon whether or not carbon dioxide also produced is removed before compression. In addition to the methane fuel produced, the residual matter in the silo is a good humus-making manure. Also, it has been much more quickly converted into such a manure than by the normal open-stack method of composting. Good progress in developing this new idea has already been made in Germany. One plant in experimental operation is at Allerhop and both the gas and manure produced have been satisfactorily tested. Some of the practical problems still remain to be solved. It appears that the size of the gas-producing installation is sufficiently large to produce economic difficulties. If the bacterial fermentation can be accelerated, smaller silos and gas storage tanks could be used; also, the compressing unit is costly and its elimination would be a considerable economy. To sewage engineers, of course, there will be little novelty in this idea of producing methane from the anaerobic fermentation of organic matter; what is new is the attempt to adapt the process to a unit size suitable for a farm.

Styrene Co-Polymers

London Colour Chemists Hear Paper

A PAPER on 'Styrene Co-Polymers—Recent Work on the Course of the Reaction' was presented by Mr. F. Armitage and Dr. S. Kut to the London Section of OCCA at its meeting on 16 January. Dr. F. W. Stoyle, the chairman of the section presided.

Mr. Armitage introduced the work that had been done recently in the authors' laboratories by giving a brief resumé of the commercial development of the materials to date, and of the work which had been done previously on the mechanics of the reactions. About as long ago as 1900, he said, there was a disclosure of a material which in some ways resembled the styrene co-polymers of to-day, although perhaps the process had then borne as much relation to the carefully worked out manufacturing processes of to-day as did Leonardo's flying machine to the present day aeroplane.

Dr. Kut dealt with some of the later work, which had shown that, when sorbic acid and β-elaeostearic acid were reacted with styrene in xylene solution, a free radical co-polymerisation of the monomers proceeded simultaneously with the formation of the Diels-Alder adduct. It was suggested that the co-polymerisation probably proceeded through a 1, 4 addition of the styrene to the conjugated systems of the acids. In addition, he described a method for separating free polystyrene from styrenated (and non-styrenated) drying oil fatty acids. The method was equally applicable to the separation of unsaponifiable material from ordinary unmodified drying oils.

Chemical Exports Allegation

A BAN on its exports to the U.S.A. has been ordered to be placed on a Montreal chemical firm which has been accused of the alleged secret shipping of strategic war chemicals to Communist Hungary.

The firm concerned, Continental Pharma, is owned by Eugene Hecht, half-owner of a Belgian firm of the same name, which with the A. E. Ratner Chemical Co., of New York, were allegedly involved in the transactions. All three come under the U.S. ban.

Accusation made by the U.S. Commerce Department, Washington, is that a considerable quantity of aluminium oxide, 'a strategic commodity usable in the manufacture of machinery for war purposes' was said to have been delivered to the Hungarian Heavy Industries Foreign Trade Company.

Original export licences were stated to have been authorised only for Belgium, but it is alleged that although this was said to have been known to both firms the goods were delivered to Hungary in 1949, after a profit-sharing arrangement was stated to have been arrived at.

A report from Washington says that the order barring the three firms has been stayed pending an application to the U.S. Commerce Department's appeals board.

International Organisation

ORGANISATION of St. Maurice Chemicals, Ltd., as a company owned jointly by Shawinigan Chemicals, Ltd., of Montreal, and Heyden Chemical Corporation, of New York, to produce formaldehyde and pentaerythritol in a $2,000,000 plant near Montreal, was announced recently.

The plant is to be built at Varennes, on the south shore of the St. Lawrence opposite the lower end of the Island of Montreal, accessible to deep-water shipping. Survey work is now under way and actual construction, expected to begin early in the spring, is to be completed about the end of next year.

The plant will occupy 30 of the several hundred acres owned there by Shawinigan Chemicals, which is a wholly-owned subsidiary of The Shawinigan Water and Power Company.

St. Maurice Chemicals' plans call for the annual production of 30,000,000 lb. of formaldehyde and 3,000,000 lb. of pentaerythritol. It will mark the first Canadian production of the latter product.

Glass Radiation Director

The incorporation of silver in glass has led to the development in the U.S.A. of a material that can be mass-produced as a dosimeter. Scientists of the Naval Research Laboratory discovered that glass containing appreciable amounts of silver and exposed to γ-rays and X-rays reveals the extent of exposure by the amount of orange fluorescence it emits under ultra-violet light. It is sensitive to as little as 10 Röentgens of radiation.

Chemical Engineers at Manchester

Mr. L. P. O'Brien Addresses North-Western Branch

THE president of the Association of British Chemical Manufacturers and chairman of Laporte Chemicals, Ltd., Mr. L. P. O'Brien, was the principal guest at the seventh annual general meeting of the North-Western Branch of The Institution of Chemical Engineers at Manchester on 18 January. Mr. O'Brien presented a paper entitled 'The British Chemical Industry—A Miscellany after Fifty Years' Service'. Sir Harold Hartley, K.C.V.O., M.C., F.R.S., president of the Institution, was also present.

The meeting opened in the Conference Hall, Town Hall, Manchester, when the chairman, Mr. G. Brearley, announced that the Lord Mayor of Manchester would be unable to welcome members as planned owing to the fact that the Lady Mayoress had met with an accident while carrying out an official duty in the morning and was in hospital. He added that it was hoped that the Lord Mayor would be able to be present later on, but as it was found that the Lady Mayoress had dislocated her shoulder this proved impossible. Mr. Brearley said that he had already sent a members' expression of sympathy at the unfortunate accident, and after welcoming the president, Sir Harold Hartley, he began the official business.

The hon. secretary, Dr. J. S. Hunter, presented the Report of the Branch Committee and, in the absence of Major F. H. Bramwell, the hon. treasurer, the balance sheet for the year 1951. Among the points raised by Dr. Hunter was that while the branch had increased its membership, some deterioration in the level of attendance at recent meetings had been noted. The committee was reviewing possible causes and would take whatever steps were considered desirable to deal with the matter. Any suggestions from branch members would be welcomed. It was felt that attendance depended upon the brilliance of the papers presented and the committee was anxious to

Above: Sir Harold Hartley, president, addressing members at the annual meeting. Also shown (from left to right) are Dr. J. S. Hunter, Mr. L. P. O'Brien, and Mr. G. Brearly, chairman

receive papers from members and the Papers Sub-committee would do everything it could to assist members in preparing papers. Printers' demands put a serious obstacle in the way of the potential author. He expressed regret at the fact that Major Bramwell had resigned from the office of honorary treasurer at the end of the year. He was giving up business and leaving the North West Area. He had carried the responsibility of his office since its inception in 1947 and the committee wished to record its thanks to him for the care and attention he had given to branch financial matters and for the service he had rendered to the branch in general.

Dr. Hunter also expressed the committee's pleasure at the formation of a new area section in the Leeds district and at the programme of the Chester district section. As the interests of graduates and students was a matter of importance the committee was anxious that every encouragement should be given to these Area Sections of Graduates and Students.

He stated that the committee, on behalf of the branch, wished to record its sincere appreciation to the directors of Petrochemicals, Ltd., for the arrangements and hospitality on 6 and 9 July when members visited the Carrington works of the company.

The following honorary officers were declared elected for the year 1952.

Chairman, G. Brearley; vice-chairman, P K. Standring; hon. secretary, J. S. Hunter; hon. treasurer, J. M. Wishart; members of the committee, G. R. Elliott, H. E. Charlton, G. E. Sachs, E. C. B. Bott, H. S. Pink, J. A. Storrow, J. L. Rosenbaum, H. Stromberg and A. J. Moyes.

Sir Harold Hartley, after being welcomed by Mr. Brearley, briefly addressed the meeting. His year of office as president of the Institution, he said, had been a great experience for him. He had enjoyed getting acquainted with members. A recently published report had been most enlightening, for it had pointed out that while nearly 5,000 chemical engineers were being turned out each year in America, Britain was only producing approximately 200. The opinion had been expressed that this was one of the most serious factors this country had to face with regard to productivity.

He had a bit of news for them. He was going to South Africa in March to take part in what he hoped would be the institution of a South African branch. This would be the first overseas branch of the Institution.

So much of the future of the Institution depended upon its branches and their work and the North-Western Branch was the oldest historically and one of the most active. He would like to express his appreciation of its activities and to say how interested he had always been in the branch.

Mr. Brearley, in introducing Mr. O'Brien, said that they in the North-Western Branch

Dr. E. H. T. Hoblyn, M.B.E., a director of the British Chemical Plant Manufacturers' Association, is greeted by Mr. O'Brien before the annual dinner

Dr. H. Robertson, Mrs. Pirie, Dr. Hoblyn, Dr. J. M. Pirie (hon. editor, Institution of Chemical Engineers) and Mrs. Hoblyn

who knew him in business thought of him as the architect of the great institution which he had built up from comparatively small beginnings and which was now known as The House of Laporte. Mr. O'Brien was a very busy man and they were extremely grateful that he should be present. As a matter of fact it had been touch and go whether he should be there or whether he should be in Australia and they were glad to see him present.

In his address Mr. O'Brien covered a wide field, discussing changes which had taken place during the past 50 years. In particular he outlined the history, organisation and work of the Association of British Chemical Manufacturers and spoke on the achievements and importance of the British chemical industry. He also outlined changes which had taken place in industrial and financial organisation. In 1914, he said, the first 12 of the largest shareholders

Dr. J. S. Hunter (hon. secretary), Mr. Tom Penny (a past chairman), Mrs. Powell, Mrs. Hunter and Mr. L. Powell

of most major companies would be private individuals but to-day probably not one of the largest would be a private individual. This was due to profit and income taxes and death duties.

Finally, Mr. O'Brien said that on the board of his company they had a number of technical men. He could not conceive any modern chemical company without either chemists or chemical engineers as directors.

In the evening the branch held its annual dinner and dance at the Midland Hotel, Manchester. The toast 'The Institution of Chemical Engineers North-Western Branch' was proposed by Sir Harold Hartley and Mr. G. Brearley, the chairman, replied. The branch was, he said, seven years old that day and thanks to the foundations which had been so well-laid by his predecessors, they were beginning to grow. Two sprouts had already appeared in the form of Graduates' and Students' Sections in Leeds and Chester. On behalf of members he thanked the back-room boys—Messrs. Hunter, Stromberg, Bott and Sachs—for making the arrangements for the dinner. The health of the guests was proposed by Mr. P. K. Standring and responded to by Mr. O'Brien.

Fertilisers & Subsidies

More Nitrogen on Grassland Urged

CONFIDENCE in the future, despite the problems of insufficient machinery, shortage of feeding stuffs, lack of capital and scarcity of labour which confronted farmers, was expressed by Sir William Gavin, C.B.E., chairman of Scottish Agricultural Industries, Ltd., at its 24th annual general meeting held at the North British Station Hotel, Edinburgh, on 17 January.

The world food position was briefly surveyed by Sir William, who emphasised that increased production must be a priority task. How this was to be achieved, must of course vary in different localities, but the full use of fertilisers was essential.

In this connection continued Sir William, the company's report showed that fertiliser sales were 11 per cent lower than in the previous year.

This did not necessarily mean that less fertilisers were actually put on the land since the figures were complicated by accumulation of reserves prior to the removals of the subsidy in July, 1950, and 1951. The indications were that consumption during the past season was approximately maintained.

It would not be wise, however, to forecast that this would be the case for the current year. The last rise in prices was very severe indeed, and even with the reintroduction of the subsidy on phosphates which had now been promised, it must result in a heavy burden at a time when farmers were faced with rising costs in every direction. Moreover, the possibility of still higher prices for both fertilisers and feeding stuffs could not be dismissed.

Relief for Phosphatic Fertilisers

As superphosphate manufacturers, the company welcomed the relief promised in the price of phosphatic fertilisers and urged farmers to take full advantage of it, and at least maintain their present usage. From a national point of view, however, an even greater need was to increase the proportionate use of nitrogen, particularly on grassland. At present only 39 lb. of nitrogen are used in Scotland for every 100 lb. of phosphoric acid. An interesting commentary on this was that in Holland the corresponding figure was 115 lb. of nitrogen, and even so the authorities there were urging the use of more nitrogen.

To confine the subsidy for this year to phosphatic fertilisers which had suffered such a phenomenal rise in price was perhaps tempting and administratively simple. But when statutory authority comes to be sought—authority which may possibly form the basis for future extension of the subsidy—it would be prudent to include provisions for spreading the subsidy over other plant foods if at any time this seemed desirable in the interests of food production.

Sir William thought that the present system of feeding stuffs rationing was employing thousands of people to little purpose. If, however, the system could be modified to stimulate more self-sufficiency on those farms capable of it, using the feeding stuffs thereby saved to reinforce supplies on farms where any increase of live-stock is impossible without them—then rationing might really do some good.

Trading results, before providing for taxation, were £200,000 higher at £914,000. An increase of £1,750,000 in the authorised capital was approved, and the dividend maintained at 7½ per cent.

Cathodic Protection in Refineries

The Use of D.C. & Expendable Anodes

THE technique of cathodic protection has long served to good advantage in preventing damage by corrosion in long-distance pipe. Its use in refinery practice, on the other hand, has until recently been limited to isolated instances. Interest in this application is only now becoming widespread and the technique promises to assume major importance in the reduction of plant maintenance expenses.

Corrosion of metals is, in the main, an electrolytic process. Under deleterious conditions, a couple is formed in which the cathodic parts of the metal surface can evolve or depolarise hydrogen at a limited rate, which is normally equivalent to the rate of anodic dissolution (and consequent corrosion loss). The object of cathodic protection is to maintain at the metal surface a supply of negative electricity (supplied from an external source) which is adequate to neutralise positive ions (in aqueous systems, hydrogen) with which it comes into contact. As a result, the surface of the metal cannot become ionised and cannot therefore undergo anodic dissolution.

In the process of cathodic protection, the neutralised protons are released as gaseous hydrogen which tends to form a protective film on the metal surface. Conditions of flow thus become a controlling factor in the amount of cathodic protection required: turbulent flow in the corrosive medium reduces the film thickness rapidly and thus necessitates a large supply of negative electricity to the endangered metal surface.

Two Methods Available

Two fundamental approaches are available for the cathodic protection of refinery equipment: (a) use of D.C. electricity supplied from a power source, and (b) application of an expendable anode which is corroded in place of the metal to be protected. The two systems are mutually complementary. Rectified current is most advantageous for the protection of large metal surfaces (*e.g.*, bottoms of large tanks) and where cathodic protection calls for particularly high current expenditures due to the existence of particularly corrosive conditions. Expendable anodes, which permit the use of a simple installation, are more suitable for the protection of relatively small surfaces (tube sheets in heat exchangers, small storage tanks, short pipelines, etc.). At the same time, their use is indicated at sites where great care must be taken to reduce fire hazards completely, such as is the case in natural gasoline plants.

An Exmple of an Installation

A typical installation for cathodic protection of storage tank bottoms by the use of applied electricity will consist of iron or carbon rods which serve as anodes in the protective circuit. The electrodes are embedded vertically at regular intervals in a trench surrounding the tank and filled with fine coke particles, or in auger holes filled with closely packed coke. Voltage is impressed on a D.C. circuit in which the carbon (or iron) rod serves as anode, and the surface to be protected is the cathode. Typical current consumption is 10-15 ampères for a 50,000-barrel tank. However, this figure varies widely with soil conditions, as will be outlined below.

Although theoretical voltage requirements are less than 0.5 volts in most instances, a potential of 5 volts must be applied to allow for various soil losses. Electrical efficiency of the system is therefore very low. Power consumption may become excessive under highly corrosive conditions, unless other steps are taken to supplement cathodic protection as a means of minimising corrosion (most effective means in most instances is the use of surface coatings, which will be discussed below as a technique supplemental to cathodic protection). Installations of this type require periodic replacement of the anodes which are being wasted away. Theoretical consumption of iron anodes is at the rate of 15-20 lb./year/ampère flowing, while graphite is theoretically burned to carbon dioxide at the rate of 4-5 lb./year/ampère.

The use of highly electropositive metals, such as zinc, or most commonly magnesium, as expendable anodes is perhaps of even greater significance in the protection of refinery equipment. Protection is afforded to the steel surface to be protected by the formation of a simple couple. In the case of tank bottoms, protection is achieved by

surrounding the tank with underground slabs of magnesium which are connected together by means of copper leads. Connection of the anode ring to the tank is accomplished through a current-limiting resistor in order to permit control over the rate of current flow. Suitable resistor systems varying over a wide range are now available to the trade.

Water-Cooled Condensers

Different systems must be used to afford cathodic protection to operating equipment in petroleum refineries. Of greatest potential importance is the use of this method in its application to water-cooled heat exchangers and condensers. In this connection, cathodic protections is confined to prevention of galvanic or bimetallic corrosion, and to combating of attack by cooling water on the steel shell of the exchanger. Where corrosive fluids are employed inside the tubes, the usual answer to the problem of metal dissolution and breakdown is the use of suitably resistant alloy steels. The use of cathodic protection in this connection is limited by the inability of the expendable anodes to 'throw' for appreciable distances. As a result, protection would be provided only in the immediate vicinity of the couple, and protection along the length of the tubes would call for a complicated and flow-disturbing arrangement of anodes. Furthermore, current and electrode consumption would be excessive for protection of metal surfaces from highly corrosive conditions. Thus it has been found, for one set of conditions, that complete cathodic protection can be provided for steel in moving fresh water by the application of .01-.02 amps./sq. ft. Protection against the extreme case of hot sulphuric acid would, on the other hand, have called for nearly 40 amps./sq. ft.

The use of alloy tubes, however, brings about more limited corrosion problems of its own. Quite commonly, the headers, tube sheets, and shell, are constructed of a more common metal (say, carbon steel). In that case, galvanic corrosion becomes a serious problem. Invariably, the higher alloy is the cathodic element of the couple so that the corrosive attack is directed against the steel parts of the system. Protection is particularly important in the areas immediately adjacent to the alloy steel. Where the tube sheet is carbon steel, this will be the point of principal attack. If, on the other hand, the tube sheet is made of the same alloy steel as the tubes themselves in order to overcome this difficulty, the problem is merely transferred to the point of contact between the sheet and the shell. Here, the area of contact is more limited and the sphere to be protected is therefore smaller in size. However, the more limited area will be exposed to more drastic corrosive action by the galvanic currents set up, and local corrosion tends to be all the more severe, therefore, unless it is prevented.

Now commercially available are anodes in the form of threaded lengths of magnesium alloy which can be screwed into half-couplings permanently mounted in the tube sheet. As the anode becomes wasted it can be readily replaced—usually this can be effected at the times of periodic inspection which are called for anyway.

For the protection of flat steel surfaces, slab-type magnesium anodes may be employed. In a typical installation, these units are attached to the steel surface by means of a single bolt. The area immediately underneath the anode is protected by insulating sheets. Passage of current through the connecting bolt is regulated by means of washers of selective resistivity.

Need for Field Measurements

The current output for adequate cathodic protection of refinery equipment should be established by field measurements. In many instances, protection may be confined to 'hot spots' on the threatened surface. Their location can be readily established by experimental means. In instances where field measurements are not immediately possible, an estimate of the required current output may be made by taking account of the prevailing corrosive conditions. For the protection of steel heat exchangers containing alloy tubes and exposed to fresh water, Parker recommends a preliminary assumption of 10 ma./sq. ft. exposed surface (excluding tube metal). This determines the length of magnesium anode required for the purpose. For an estimate of current output, a knowledge of the water analysis is required, and the following formula may then be applied for magnesium rod of nominal 1-in. diameter (actual diameter: 1.315 in.):—

$$I = \text{ma./ft. or rod} = \frac{\text{p.p.m. of total dissolved solids}}{13}$$

Rated total capacity of such a 1-in. magnesium rod is approximately 60 ma.-yrs./ft.

To estimate current requirements for the protection of tank bottoms, a knowledge of soil conditions is required. Average values can be estimated from the following data:—

Steel in well cured, halogen-free concrete	.07 ma./sq.ft.
Steel in anaerobic natural soil water	.5 ma./sq.ft.
Steel in aerated natural soil water	3.0 ma./sq.ft.

An important reduction in estimated current requirements is often possible if the total water hardness (calcium and magnesium) exceeds 35 p.p.m. Above this value, there is a tendency for these metals to 'plate out' on the steel surface and thereby provide a protective coating. This effect is, however, largely cancelled out by the presence of turbulent conditions or by other mechanical disturbances.

Of course, a large reduction in current demand may be effected by providing the steel surface with artificial protective coating, as is already common practice in underground piping. In that case, the need for cathodic protection may be lowered to 2 per cent of its value for the bare metal. The formation of local pin holes in the coating results in dangerous 'hot spots' which are largely protected by a concentration of negative electricity in the endangered area if adequate cathodic protection is provided.

Record Number Elected

Textile Institute Examination Results

FOR the first time in any one year the Textile Institute last year elected more than 100 candidates as Associates of the Institute, following a record entry for its examination. The total of 117 new A.T.Is compares with the highest previous figure of 86, in 1947. Latest elections are given below.

Elected to Fellowship, are:

Frederick McKay, B.Sc., A.M.C.T., A.T.I., Head of Textile Department, Blackburn Technical College, the author of a comprehensive report on the war-time cotton industry for H.M. Government's Historian.

D. B. Das, M.Sc., Ph.D., A.R.I.C., Acting Chief Chemist, Group Laboratories, Jardine Henderson, Ltd., Calcutta, who for a number of years has been responsible for research work on the science and technology of fibres, and has published several papers and articles on scientific aspects of jute manufacture.

Among the Associates elected are:—

J. P. Niemira, Works Chemist, Walkden, Makin & Co. Ltd., Manchester.

G. M. Swidzinski, B.Sc., Chemist, I.C.I. Ltd., Dyestuffs Division.

M. M. Zegota-Rzegocinski, Assistant to Head of Testing and Research Department, Bulmer & Lumb, Ltd., Bradford.

M. C. Pool, B.Sc., A.M.I.Chem.E., Assistant to the General Manager, Rayon Staple Division, Courtaulds Ltd.

Samuel Mitminger, B.Sc.Tech., A.M.C.T., Technical Assistant, Weaving Department, Canadian Celanese Limited.

K. N. Ramachandran, Research Officer in charge of Wool Research Laboratory, Poona, India.

Canadian Law Case Ended

AFTER 11 years of litigation, a settlement has been reached between the Chemical Research Corp., the Gyro Process Co. and the American Locomotive Co. and a cash payment of $2,812,500 has been made to Chemical Research and Gyro.

In addition to the cash settlement, American Locomotive transfers to Chemical Research their 10 per cent ownership in the Gyro Process Co., thus giving it 100 per cent ownership of the latter company.

At a meeting of directors of Chemical Research held in Detroit, a special committee was appointed to undertake the rehabilitation of the Chemical-Gyro companies, the activities of which have remained dormant throughout the long period of litigation. The committee was composed of T. W. MacDowell, president of company; J. Bradley Strait, Canadian financier, and A. W. Wallace, vice-president of the company.

First Indian Atomic Pile

India will erect her first atomic pile within the next two years, according to *Indian Trade and Industry*. French experts are to assist with the construction of the pile, and two other foreign governments are expected to co-operate. The pile will be situated in Southern India, near the Travancore coast, where lie the large deposits of monazite sands—a rich source of thorium and uranium. The pile will be used for experimental purposes and for the production of isotopes.

Brazil's Import Needs

Growing Demand for Sulphur & Zinc

SULPHUR, zinc and cellulose figure prominently among the vital products required by Brazilian industry according to a recent report by the Brazilian Economic Council which listed the major imports that it considered should be continued. The list included the following items with the quantities (in tons) considered necessary: cellulose, 120,000; sulphur, 80,000; zinc, 14,000; emulsifying oils, 120,000; sodium carbonate, 80,000; natural phosphates, 55,000; sodium nitrate, 10,500; carbon black, 10,000.

Sulphur Requirements Increased

Brazil's requirements of sulphur have increased from 3,800 tons in 1931 to an estimated total in 1952 of 97,000 tons, of which 65 per cent is in the form of sulphuric acid. The Export-Import Bank received applications to import 71,238 tons during the first half of 1951, prices ranging from £25 4s. for American, to £67 12s. for French sulphur. Three factories, one belonging to the Ministry of War, are extracting sulphur from iron pyrites and the National Steel Works at Volta Redonda is to produce sulphur from the pyritic rejects of Santa Catarina coal. These are now estimated at 322,000 tons annually, with 26.23 per cent sulphur and 16 per cent carbon, and are expected to yield 84,740 tons of sulphur (THE CHEMICAL AGE, **65**, 127).

Two factories, one in Rio and one in S. Paulo, are producing zinc oxide by French processes, using imported zinc. Both are now having difficulty in obtaining supplies, as exports from the U.S.A. are restricted, while the price of Mexican and Belgian zinc is prohibitive. During the first six months of 1951, 6,133 tons were imported at an average cost of £224 13s. 7d. per ton. In October a few licences were granted to import lithopone. Only one of Brazil's three known zinc deposits is at present exploited, namely that at Januaria, in Minas Geraes. In this, zinc occurs in the form of willemite (Zn_2SiO_4). In the other deposits it occurs in the form of zinc blende.

In 1950 Brazil produced 40,000 tons of cellulose and imported 131,769 tons. Cotton linters, linen, caroa and other fibres are the principal raw materials used locally for its manufacture. A new plant is being installed, however, to work with bagasse of sugar cane, and a project is under consideration to make pulp from eucalyptus trees. In view of the number of new techniques now available, a review of the entire cellulose problem was recently recommended by Mr. Roy D. Rivers, writing in *Brazilian Business*.

Of the cellulose consumed in Brazil some 90 per cent is used in the manufacture of paper, production of which has increased by 140 per cent since 1937 amounting to a total of 247,894 tons in 1950, although imports have remained steady at about 70,000 tons for the last 10 years.

Profits of the chemical industry were revealed in the November issue of *Conjuntura Economica*, an official publication, which gave the results of its examination of the 1950 balance sheets of 276 manufacturers of chemicals and pharmaceuticals in Brazil. Total capital of the companies concerned was given as £46,180,000; capital plus reserves £71,180,000; total profits £13,980,000; of which £9,380,000 was retained and £4,160,000 distributed. The percentage of profits on capital (after deducting losses), compared with 1949, increased from 22.5 to 29.00; on capital plus reserves, from 15.9 to 18.8. The percentage of dividends on capital decreased from 10.1 in 1949 to 9.0 in 1950.

Total profits in the Brazilian chemical and pharmaceutical industries increased by 55 per cent in 1950, while invested capital increased by 14 per cent.

'Warfarin' Described

THE U.S. National Better Business Bureau has issued a bulletin giving details of 'Warfarin', the new potent rat-killer recently discovered at the University of Wisconsin. The bulletin says that 'Warfarin' is an anti-coagulant which produces painless death to animals by causing internal bleeding. It must be taken in small quantities for several days to produce death, and, used in concentrations of 0.025 per cent as recommended for rat and mouse control, there is a minimum danger to other animals, which danger can be reduced further by the use of baits that flesh-eating animals do not like. It should not be described as harmless to humans; a complete cure, or a cure for ever; a preventative against re-infestation; and the only successful rodenticide. The Bureau suggests that advertisements therefore confine themselves to the facts.

Background to Krilium

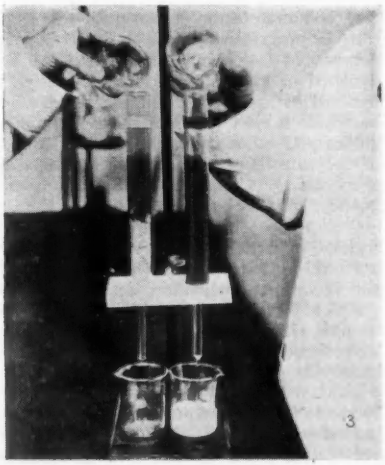
Monsanto Discloses Technical Data For Soil Improver

THE technical background to Krilium, the new soil-improver recently announced by Monsanto, for which such startling claims have been made, has recently become available. Krilium is the name given to a series of synthetic resin soil conditioners, among them a hydrolysed polyacrylonitrile and other experimental polyelectrolytes, which show spectacular power for improving the mechanical structure of high-clay-content soils. Its announcement has given rise to much comment, for the potential value of this substance, if it fulfils its makers' claims, should be very great both in agriculture, soil surface maintenance and in erosion control. Monsanto is at the moment expanding its facilities for commercial-scale production of the improver. Universities in the U.S.A. federal and state agencies, the armed forces and commercial firms are stated to be field-testing Krilium with the object of evaluating its effects and determining its best methods of use.

Monsanto Chemicals, Ltd., London, are planning an early supply of limited quantities of Krilium for scientific trials under British conditions.

The physical properties of soil are largely controlled by two factors: soil texture and soil structure. Soil texture is determined by the relative *amounts* of the different particle sizes, occurring as sand, silt and clay; soil structure by the stable *arrangement* of these primary particles as they stabilise themselves in aggregates. Good soil structure is therefore a problem of the arrangement of the soil particles—the most satisfactory apparently being stable aggregates that range in size from a pinhead to a pea.

It is a known fact that certain natural gums of the polysaccharide or polyuronide types, occurring naturally in adequate quantities in good topsoil, are responsible for cementing together primary soil particles to form water-stable aggregates of optimum size—thus creating good soil structure by their bonding action. These naturally occurring polysaccharides are formed in small quantities as minor by-products of the decomposition of plant residues, manures, composts and other organic matter. It requires from 50 to 100 tons of manures or other residues, however, to produce one ton of polyuronides. The natural soil-binding gums, moreover, are rapidly decomposed by soil bacteria, making it necessary to keep adding humus in the shape of large amounts



This infiltration test, conducted at Monsanto's laboratories in Ohio, shows how equal amounts of water affect untreated soil (left) and soil treated with Krilium (right). The untreated soil obstructs the passage of water by slaking and clogging. Treated soil lets all the water through and remains crumbly with no evidence of mud

of organic matter to maintain the soil structure in the condition of a loose, porous mass.

Good soil management requires attention to at least four factors:—

1. Supply of organic matter;
2. Nutrient level (fertility, chemical substances, especially nitrogen, phosphorus and potassium available to plants from the soil);
3. Soil structure; (tilth—condition of aggregate mass).
4. Depth of arable soil (topsoil layer capable of supporting crops).

In general practice, keeping soil in good tilth requires continuous attention to type of crop and intelligent rotation, cover cropping with grass or legumes, green manuring and proper use of crop residues or manures. Much time and labour are required.

Good Tilth Essential

However; it is essential for high yields and sturdy growth because it (a) permits easy intake and assures good retention of rainfall; (b) provides a plentiful air supply for root respiration; (c) offers less resistance to penetration by plant roots; (d) promotes easier tilling over a wider period of time; (e) stimulates activity of soil organisms with increased yield, and (f) permits easier placing of seeds and emergence of seedlings. Further, good tilth enhances the effectiveness of commercial fertilisers.

The structural characteristics of different kinds of soil vary widely. When cultivated continuously, various soils react differently. One common factor, however, is that good tilth is progressively lost. Soils become denser and less granulated. When soil has depleted or exhausted its organic matter, it has lost its ability to drain and breathe. It becomes subject to puddling, washouts, gullies and other forms of erosion. Because of the lack of pore space between separate aggregates, its moisture absorption and holding capacity are low; cracks or fissures may develop which hasten water loss. In regions of little rainfall, saline flats with cracked, crusted surface and layers of hardpan at various depths may develop.

Krilium resin is a synthetic replacement for the natural polysaccharide or polyuronide resins derived from humus. In structure improving power, 1 lb. of Krilium seems equivalent to the natural gums produced by 100 to 1,000 lb. of manures or plant residues. Indications are that Krilium retains its aggregating power against decomposition by soil micro-organisms in some cases at least ten times as long as the natural crude organic matter.

The primary effect of Krilium on ordinary soil is at once to stabilise clay aggregates against the dispersing or slaking action of water. Almost any soil, with sufficient mechanical labour and proper time of cultivation, can be worked into a loose porous condition. However, only soils of good tilth retain this aggregated structure under the onslaughts of rainfall which disperse and slake the clay fraction.

Krilium polymer is a water-soluble resin; in aqueous solution it exists as a polyanion with 100 or more negative charges on each ion. When Krilium is dispersed in soil, its hygroscopicity helps it to dissolve in soil water. The polyanions are presumably adsorbed to colloidal clay particles, binding these through the carbon linkage 'bridge' between reactive groups on the polymer—the basis of the soil conditioning effect. Experiments bear this out, the ultimate level of adsorption being roughly equal to the anion exchange capacity of the clay.

Two points must be clearly understood about the mechanism of aggregation:

(1) Although Krilium is water-soluble (a necessity for adequate dispersion), the reactive groups are adsorbed on to the clay particles by exceedingly powerful forces of attraction and they cannot be leached out with water.

(2) The maximum aggregating effect at lowest concentration is obtained in the presence of small amounts of sodium, calcium, magnesium and other cations. In most natural soil, these cations are present.

Mechanical Dispersion Necessary

From the foregoing, it becomes apparent that conditioning soil with Krilium needs enough mechanical dispersion of the material over or through the soil to allow its solution in the soil moisture. For conditioning soil in depth for agricultural uses, this necessitates discing, harrowing or raking in Krilium to a depth of up to six or more inches.

For stabilising soil in erosion control work, Krilium is scattered evenly on top of the soil as a 'holding' treatment until a vegetative cover can form. This establishes a water-permeable resin film on the soil which acts as a stable surface conducive to the ready germination of seed.

The effects of Krilium treatment on soil

structure are said to be dramatically apparent. The formation of clay aggregates is readily observable within 24 hours of treatment. The soil mass becomes porous and friable; numerous round, spongy balls appear, ranging in size from a pinhead to a pea, which retain their character with subsequent raking or other mechanical movement. The treated soil is remarkably easy to work, offering minimum resistance to plough, harrow or spade.

Some water, as well as adequate dispersion of Krilium, is necessary for the formation of clay aggregates. The optimum amount varies, but generally 15-20 per cent by weight in the soil gives satisfactory formation of crumbs. Krilium is best applied to a dry surface with moistening to follow—either by working the resin into the more moist sub-surface soil, by rainfall or by wetting down.

One of the most spectacular effects produced by the addition of Krilium to clay-type soils is the raised water-holding capacity of the soil and its workability at higher moisture content. As an example, 45 parts of water added to 100 parts of Paulding clay produces a muddy 'soup'. When 0.1 per cent of Krilium has been added beforehand to the soil, the same amount of water produces a moist, crumbly, easily worked mass of small aggregates.

Stability of the aggregates is demonstrated simply. If crumbs of treated and untreated soil are covered with water in a beaker, the untreated soil will slake down into a flat layer on the bottom. The treated soil crumbs show no such disintegration, and maintain their aggregation in water indefinitely unless mechanically crushed.

Evaporation Losses Reduced

Formation of the clay aggregates results in a much more porous soil structure having increased amounts of both capillary and non-capillary pores. This increased capillary space accounts for the greater water-holding capacity of the treated soil and, because the capillary spaces in the aggregates are not continuous with lower soil layers, greatly reduced water loss by evaporation. The non-capillary pores contribute to drainage and aeration.

Water has been found to climb by capillary action to the top of a glass cylinder three times more rapidly in a treated than in an untreated column of soil. Also, when equal quantities of water are spread on to

Geraniums grown in soil treated with Krilium show faster and fuller growth than those grown in untreated soil

equal areas of contained soil, the water on treated soil disappears much more rapidly than that on untreated soil of the same lot.

Soil aggregation is often doubled or tripled. The amount of water-stable aggregates larger than 0.25 mm. in untreated Miami silt loam is usually 20-30 per cent, whereas treated with 0.1 per cent Krilium under laboratory conditions it is often 90-95 per cent. A 0.05 per cent treatment will give a value almost as high, except that most of the aggregates are on the smaller sieve. In general, duplicates check within a few per cent.

More rapid infiltration of water occurs after Krilium treatment, with less run-off during rainfalls. This can mean lower irrigation costs in dry areas and less seasonal water stress for plants in areas of higher rainfall. Field capacity or moisture equivalent is also increased up to 30 per cent in Miami silt loam with little or no change in wilting point (this factor alone results in an approximately 40 per cent increase in water available to the plant in the treated layer), and evaporation of moisture from the surface of a treated soil has been determined to be from 30-40 per cent slower than from soil of the same lot untreated. The latter not only saves soil water but would decrease the harmful deposition of water-soluble salts on the soil surface in

irrigated areas. Crops in almost all areas suffer from water shortages during at least a portion of the year.

Treated soils usually exhibit a loose friable mulch of soil and less tendency to crust. They shrink and crack less upon drying, and the surface of a treated soil appears dryer and can be tilled more satisfactorily when the soil contains more moisture. This mulch-like structure of the surface probably accounts for reduced evaporation, in spite of the fact that it also promotes larger soil air spaces and hence increased water infiltration.

Better Oxygen Supply

Soil aeration is improved significantly by Krilium, resulting in a better supply of oxygen to plant roots. In tests, yeast was able to obtain as much oxygen in a treated soil containing 62.5 per cent moisture as in an untreated soil containing only 37.5 per cent. Good aeration greatly encourages desirable soil microflora, including symbiotic legume bacteria. Actual tests with treated soil in perfusion tubes resulted in equal or increased nitrification in all cases. In some cases, nitrification was nearly doubled during the first 12 days. Natural soils were used with no bacterial cultures added. It is possible that this improved aeration may also aid in reducing fungal and other soil-borne diseases, including damping-off and root-rot organisms.

Encouraging of desirable aerobic organisms with concurrent discouraging of undesirable anaerobic types offers an interesting avenue of investigation.

Root penetration should be enhanced greatly in treated soils. The improved aeration and moisture relationships provide physical conditions conducive to better plant nutrition. This, in turn should stimulate greater root growth. Increased root development left in the soil after harvest should improve the underground drainage and organic matter relationships.

The effect of Krilium soil treatment on plant growth has been shown in the limited tests carried out to date, to improve crop growth and quality wherever poor soil structure is the cause of poor yields.

In its effect on plant growth, Krilium treatment appears to give a consistent improvement in the quality of carrots and other root crops. The degree of yield response undoubtedly will depend upon the extent to which the physical structure and related aspects of the soil are limiting factors. Some of the increases in yield were a result of improved stand. The rest were from increases in size, a factor not always apparent in root crops from observations of only the above-ground part of the plants.

Timing in the use of Krilium treatment apparently is not too important, except that the soil surface should be rather dry and in a condition that favours thorough mixing, so that it can be given the maximum immediate working-in without needing too much additional operation beyond normal planting or tilling. The logical time of application appears to be at the time of seed bed preparation or actual planting, coupled with regular operations.

In the laboratory, maximum aggregation of soil particles was obtained with soil moisture content of around 30 per cent. This level is not practical for good field workability, but it suggests that Krilium treatment should be given when the soil moisture *below the surface* is reasonably high. At such times the soil will crumble more easily and better mechanical mixing will result. It is apparent that the polyelectrolyte moves little, if any, in the soil except by stirring.

If Krilium is spread on a wet soil surface or becomes wetted by a rain before it is mechanically mixed in, the resin will become gummy or slimy and thorough incorporation becomes difficult or impossible. Immediate working-in, therefore, is advisable.

Anti-Erosion Possibilities

A major use for Krilium is expected to develop in treating banks and slopes to protect them temporarily against rain erosion until vegetation develops. In combating erosion, Krilium mechanically 'holds' the soil, improves drainage, minimises packing and slaking, and aids seedling germination and emergence.

Two types of treatment are possible: the first, a surface treatment to control erosion, requires little treating effort and aims at stabilising the top surface of the soil with a continuous water-permeable film until a vegetative cover can be sprouted. The second, a shallow agricultural treatment, uses more conditioner and is aimed at quickly establishing a good vegetative cover on more level areas. In the second treatment, the user controls puddling and sheet erosion by creating the surface structure described under aggregation.

Deterioration of Cracking Catalysts

Normal and Abnormal Ageing

DETERIORATION of catalysts introduces an important cost factor into the economics of catalytic cracking. Gradual reduction in catalyst activity and selectivity causes a lowering of cracker capacity. As the degradation process progresses, the point is finally reached where the catalyst must be replaced.

In cyclic processes, e.g., the Houdry fixed-bed type, these two phases due to catalyst deterioration occur in distinct stages. Illustrative is the performance of a Filtrol clay which produced 32.9 vol. per cent petroleum, 2.4 wt. per cent coke and 3.3 wt. per cent gas when new. After 135 cycles, the same catalyst still operated at identical conditions, showed the following product distribution: 23.6 vol. per cent petroleum, 3.5 wt. per cent coke, 5.1 wt. per cent gas. A less extreme case, reported for Houdry synthetic catalyst, showed in the course of 116 cycles a petroleum drop from 38.5 to 34.9 vol. per cent., while coke rose from 2.2 to 2.5 wt. per cent, and gas increased from 6.7 to 7.9 wt. per cent.

Eventually, the point is reached where yield losses and capacity reduction make continued operation of the catalyst charge economically unsound, and the catalyst must be replaced.

Catalyst Make-up Rate

In continuous processes, of which thermofor (TCC) and fluid catalytic cracking are illustrative, a portion of the catalyst is continuously bled from the system and replaced with make-up. As a result, a constant steady-state level of activity is maintained for any given set of conditions. Catalyst replacement rate rises, of course, if a higher level of activity is to be maintained. Working at an equilibrium activity of 25, Evans found a required clay catalyst make-up rate of 1 ton per day for a 10,000-barrel-per-day TCC plant. Increasing the activity level to 29 tripled the catalyst consumption.

In all catalytic cracking processes, the operator is given a number of means for boosting throughput at any given level of catalyst activity. Principal factors at his disposal are adjustment of reactor temperature, recycle ratio, space velocity, and catalyst-to-oil ratio (in continuous processes). However, a limit is set here by economic considerations. Increasing the throughput will result in a change in product distribution—increase in gas and coke production at the cost of overall petroleum yield.

The effort to reduce catalyst replacement to its lowest possible values must thus be directed at maintaining two performance characteristics at high level: catalyst activity and catalyst selectivity. Both properties are established by laboratory cracking in standard conditions.

Catalyst Activity Defined

The activity of a catalyst is defined by the overall conversion of the feedstock into products boiling over a range other than that of the original oil. Catalyst selectivity, on the other hand, is a measure of the distribution of products and usually refers to the production of petroleum relative to coke and gas at a given level of conversion.

A useful quantitative measure for selectivity is made possible by the empirical finding that a semi-logarithmic plot of coke formation against conversion to petroleum will yield straight parallel lines for different catalysts (or catalysts at different levels of selectivity). The plot is expressed by the equation:

$$A \times \log (\text{coke}) = \text{petroleum} + (\text{coke factor}).$$

Since the lines are parallel, the constant A is the same for substantially all catalysts and has a value of 36.0. The coke factor is a measure of catalyst selectivity relative to coke. A small factor implies high selectivity.

A similar correlation expresses selectivity relative to gas by means of a gas constant.

Two types of catalyst-ageing are thus observed in cracking operations: normal ageing, which refers to a loss in activity, and abnormal ageing which refers to decreasing selectivity. In addition, continuous catalytic cracking processes call for catalyst make-up of mechanical (attrition and carry-over) losses.

Mechanical losses are inherent in the design of the cracking unit and in the physical strength of the catalyst. Recent improvements in these two aspects of cracker

economics have reduced attrition losses to as little as 0.1 lb. of catalyst per barrel of charge in TCC units. In fluid catalytic cracking operations, losses from this source are appreciably higher, ranging from 0.2 to 0.4 lb. per barrel of charging stock.

Normal ageing is an unavoidable phenomenon of the cracking process and is enhanced as the operating conditions become more drastic. The catalyst is alternately exposed to hydrocarbons at 900-975°F., combustion gases at 1,050-1,125°F., and superheated steam at about 800°F. inlet temperature. Principally responsible for normal ageing are high temperatures and steam.

Shabaker's Experiments

Shabaker exposed a clay cracking catalyst to 1-atmosphere steam for 4 hours. The catalyst so treated at 1,100°F. showed a stream-resumption activity of 33.5 per cent. At 1,400°F., the activity was lowered to 23 per cent. Exposing the catalyst to 0.1-atmosphere steam for ten hours at 1,100°F. resulted in an activity of 38.5 per cent. At 1,400°F., the activity was reduced to 26.5 per cent. Similar trends were observed for synthetic catalysts, although it must be noted that these latter materials are considerably more sensitive to steam than to high temperatures.

Thermal deactivation of catalysts in dry air is relatively insignificant at temperatures below 1,400°F. (for clays, and even higher temperatures for synthetic catalysts). Since considerations of metal strength require operation below this point, pure thermal deactivation of catalysts is a relatively minor factor in normal ageing. Similarly, CO_2, SO_2 and NH_3 have been shown to be harmless below 1,150°F. Above this temperature, the latter two are responsible for abnormal ageing of clay catalysts, i.e., they cause reduction in selectivity.

Among operating factors, the most common contributory cause to abnormal ageing of catalysts is the presence of H_2S. This factor is important only in connection with natural clays and has little or no effect in the cracking with synthetic catalysts. The reason for this is to be sought in the presence of relatively large amounts of iron in natural catalysts. This metal is known to be a catalyst for the decomposition of hydrocarbons to their elements. While iron is present in clay in an inactive form, reactions with H_2S above 800°F. brings its objectionable catalytic characteristics to the fore, perhaps due to the formation of active iron sulphide centres. For reasons not fully understood, this reaction appears to be partially prevented by the presence of ether vapour. It has been found possible to suppress abnormal ageing due to H_2S to a certain extent, by the prehydration technique which has acquired importance.

Other sulphur compounds found in the feedstock have a similar, though less pronounced, abnormal ageing effect. The extent of this phenomenon is related to the degree of lability of the sulphur linkage in the original compound. Thus, organic sulphides are quite harmful, while stable thiophene and its homologues have little or no effect on either synthetic or natural cracking catalysts.

Sulphur dioxide is objectionable in operation with natural clays at temperatures above 1.150°F. While this gas is not present in normal feedstocks, it is generated in the course of regeneration. The average sulphur content of sulphurous catalyst deposits is 10-20 per cent. It may, however, run much higher, and values as high as 60 per cent have been reported in the cracking of sulphur-rich light stocks.

The adverse effect of nitrogen compounds on catalyst activity has been widely overrated. According to recent work by Mills and co-workers, these contaminants do not appear to cause significant abnormal ageing. They do, however, tend to inhibit cracking probably by neutralising the active acid catalyst centres. Activity is restored in the course of regeneration. It should, however, be noted that ammonia *does* hasten abnormal ageing of natural clays at temperatures above 1,150°F.

Metals Interfere

Most serious is the deleterious effect of certain metals on catalyst activity and selectivity. This difficulty is encountered with natural as well as synthetic catalysts. The objectionable metals, such as vanadium, nickel, copper and iron, belong to the reducible oxide group and have a known tendency to decompose hydrocarbons, at cracking temperatures, to carbon and hydrogen.

Perhaps the least troublesome of these metals is iron. In some instances, catalyst performance has not been impaired by the presence of rouge on the surface.

Industrial Instruments Aid Production

BIMCAM Hold Annual Luncheon

BY increasing productivity, British industry can close the door to the infiltration of the Communist cold war into our national life, Sir Norman Kipping, J.P., Director-General of the Federation of British Industries, told members of the British Industrial Measuring and Control Apparatus Manufacturers' Association at their 8th Annual Luncheon in London on 15 January. Sir Norman, who is a Commander of the Order of Danneborg, into which Captain Carlsen has just been appointed, compared the 'Flying Enterprise' with 'Private Enterprise' in this country and observed that in each case it was the quality of the man that was important. He also referred to the heartening news that America was going to assist us very materially to meet our essential requirements for steel, and remarked on the great change in attitude in the U.S.A. towards our needs for raw materials. This he contrasted with the fact that since the war we have exported coal to the value of £100,000,000 less than in a comparable pre-war period, and that three-quarters of all Marshall Aid to Europe was made necessary by lack of coal.

Mr. L. S. Yoxall, chairman of the Association, recalled the early motor car, with its complete lack of those aids and gadgets which are considered essential to-day. The same applies to the progress of the instrument industry in relation to British industry generally.

Mr. W. G. Ardley, president of the Association, was in the chair and proposed the toast of 'The Guests', mentioning that Lieut.-Gen. Sir Kenneth Crawford, K.C.B., M.C., Controller of Supplies (Munitions) at the Ministry of Supply, who replied for the guests, was a qualified parachutist, 'the hall-mark of concentrated resolution'.

Sir Kenneth referred to the great part played by the industrial instrument industry in increasing productivity in the defence and vital national industries and in making possible great fuel economies, as well as directly exporting 30 per cent of its output on its own account. The importance of the instrument industry would be reflected in the steel allocation that the Ministry of Supply hoped to make to it.

The Association represents more than 90 per cent of the productive capacity for industrial instruments in Great Britain. There has been a phenomenal increase in

BIMCAM members at the luncheon

demand for industrial instruments and controllers since the war and to-day the automatic controller has taken charge of massive processes in every branch of industry, not replacing the operative but enabling him to increase output and improve quality of product.

Members of BIMCAM include:

Accurate Recording Instrument Co.; Amal Limited; Bailey Meters & Controls, Ltd.; Budenberg Gauge Co., Ltd.; Bristol's Instrument Co.; Electroflo Meters Co., Ltd.; Elliott Bros. (London) Ltd.; Ether Ltd.; Evershed & Vignoles Ltd.; Foster Instrument Co., Ltd.; Foxboro-Yoxall Ltd.; Gent & Co. Ltd.; James Gordon & Co., Ltd.; Guest & Chrimes Ltd.; George Kent Ltd.; Honeywell Brown Ltd.; Kelvin & Hughes Ltd.; Lea Recorder Co., Ltd.; Leeds Meter Co., Ltd.; Manchester Water Meter Co.; Measurement Ltd.; Rotameter Manufacturing Co., Ltd.; Short & Mason Ltd.; Tylors of London Ltd.; and Alexander Wright & Co., Ltd.

International Conferences

DSIR List of Forthcoming Events

SCIENTIFIC and technical conferences of an international character during this year and next together with some of the proposed major conferences in 1954 have been collated in a list (No. 10, January 1952) just issued by the Overseas Liaison Division of the Department of Scientific and Industrial Research.

The aim of the list is to cover all scientific and technical conferences of an international character, held in the United Kingdom, or elsewhere, of interest to Government departments, Government-supported research laboratories, and to individual scientists. It is increased by the inclusion of a wider range of conferences such as annual general meetings of some of the professional institutions, which are often of two or three days' duration, and at which scientists from other countries might also be present.

In the main the conferences listed can be assumed to be open to suitably qualified scientists on payment of the usual membership fees. With few exceptions therefore no mention is made of meetings of commissions or committees of experts such as those organised by the specialised agencies of the United Nations. Moreover, these are listed by the United Nations secretariat. Exhibitions are included when of particular scientific interest.

Conferences have been given chronologically with an index to facilitate reference to any particular subject.

Chemistry, physics, crystallography, metallurgy, chemical engineering and crop protection play a prominent part in the list, while exhibitions include instruments and measurements, and packaging.

The following are some of the events of major interest during this year:—

British Commonwealth Scientific Conference, Australia, 18 February.

Institute of Metals, annual general meeting, London, 25-27 March.

Physical Society Exhibition, 3-8 April.

Faraday Society, general discussion on Radiation Chemistry, Leeds, 8-10 April.

Conference on Adhesion, Society of Chemical Industry, London, 22-24 April.

Achema X, conference and exhibition of chemical apparatus, Frankfurt, 18-25 May.

International Union of Chemistry, colloquium on 'Radiations and Macromolecules,' Strasbourg, during May.

International Congress of Biochemistry, Paris, 21-27 July.

International Congress on Analytical Chemistry, Oxford, 4 August.

'Physical Chemistry of Proteins' general discussion, Faraday Society, Cambridge, 6-8 August.

International Council of Scientific Unions sixth general assembly, Amsterdam, 3-5 September.

British Association for the Advancement of Science, Belfast, 3-10 September.

Annual symposium on Molecular Structure and Spectroscopy and joint commission on Spectroscopy (ICSU), Columbia, Ohio.

International Symposium on Chemistry of Cement, London, 15-20 September.

American Oil Chemists' Society, Cincinnati, 20-22 October.

American Institute of Chemical Engineers, Cleveland, Ohio, 7-10 December.

Peanut Oil Displaces Diesel

Trouble in Persia has led the Indian authorities to carry out experiments with alternative fuels for diesel tractors; 50 per cent peanut oil mixed with high-speed diesel oil has been found to be fairly satisfactory, except that the price of peanut oil makes such a resort uneconomical.

The Chemist's Bookshelf

OIL, FAT AND SOAP. By Benjamin Levitt. Chemical Publishing Co., Inc., New York. 1951. Pp. 230 + viii. $6.00.

Mr. Levitt is chief chemist to the Curley Company, and is a consultant to soap industries. His book is technological in outlook and empirical in character; it is essentially a book for the practical man. It contains little of theory and nothing or next to nothing of guesswork. It has been in use in the reviewer's laboratory for some weeks and three chemists who have used it have found it useful and have liked it.

The subject matter covered is fairly reflected in the title of the book, and it is arranged in a logical and orderly way. A short historical introduction precedes a chapter on the classification and properties of oils and fats and this is followed by a discussion of vegetable oils and of animal and vegetable fats. The author then deals with soap manufacture, and with speciality soaps and processes and this discussion of soap *per se* accounts for nearly one third of the book. Then follow chapters on the fatty acids and glycerine, synthetic surface-active agents and miscellaneous tests, analysis of oils and fats, and analysis of soap and soap products. There is an appendix composed of some miscellaneous information, a small and unassuming but quite sound glossary, and a tolerable index.

One of the most interesting and important of the processes to which oils are nowadays submitted is undoubtedly that of hydrogenation, and it might have been expected that this would have been dealt with fairly fully, and that an adequate description and illustrations of modern processing and plant would have been given. In fact, the subject is treated indifferently in just over two pages.

In the chapter on soap manufacture, the description of the preparation of half-boiled soap is outstandingly good; it is clear, concise, and helpful. On the other hand, the discussion of textile soaps is meagre in the extreme and in the description of wool scouring the important point is quite overlooked that the alkali used in the scouring bowls saponifies part of the natural wool grease, so that the wool is largely washed in its own soap, or, as the foreman scourer so aptly says, it is 'scoured in its own muck'.

Recipes are given for a variety of special soaps and one was picked at random for making up, *viz.*, the brushless shaving cream described on p. 102. It appeared not to give so easy or so smooth a shave as the more popular of the brushless shaving creams that are on the U.K. market, nor indeed as other brushless creams which the same chemist had recently made up.

Soap perfuming is given a page or so of treatment, but there is little or nothing in it to guide the soap-maker to a suitable choice of perfumery synthetics. Jellinek's work on the stability of odour and colour of perfumery synthetics in soap might well have been briefly reviewed.

Prevention of re-deposition of soil on fabrics that are being laundered has received a good deal of attention of late and considerable improvement has been effected by the use of cellulose ethers, and it is believed some other colloids, but no reference to this matter could be found in Mr. Levitt's discussion of 'Theories on the Cleansing Action of Soap'.

The very important use of fluorescent compounds in soap, an attractive subject on which a writer of a new text-book might have been expected to enlarge, receives only six lines.

It is in its country of origin that a book is most useful; always there is emphasis on the 'home' and neglect of the 'foreign' products. The list of some fifty of 'the more important surface-active compounds' which is given on pp. 152-154 omits most of the best of the synthetic detergents which are made and used both in industry and for home dish-washing in the United Kingdom.

But in those chapters where Mr. Levitt has dealt empirically with oils and fats and their properties, and with soap-making, he has done the job excellently, and his book should be of considerable value to soap and to textile chemists.—R.W.M.

HOME

Record I.C.I. Output

Despite hold-ups caused by the shortage of sulphur a record production of medicines and dyes was achieved during 1951 by the Grangemouth factory of Imperial Chemical Industries, Ltd. For every 9 lb. turned out in 1950, the factory produced 10 lb. last year, many of the products contributing to the export drive. An even higher output is being aimed at this year.

Restrictions on Steel Exports

The price below which the Board of Trade restricts exports of general manufactures of iron and steel was raised from £30 to £40 a ton on 21 January. These arrangements, first introduced in July, 1950, restrict exports of iron and steel goods of a 'low conversion value', and the present increase takes account of higher iron and steel prices. Continuation of this restriction is stated to be necessary as part of the Government plan for increasing iron and steel exports of higher conversion value, including machinery.

Dutch and French Scientists Visit Sheffield

Scientists from Great Britain, the U.S.A. and European countries have been trying to work out an international system for the classification of coal, based on its calorific value, volatile matter and caking properties. In their meetings at Geneva under the auspices of the coal committee of the Economic Commission to Europe scientists found difficulty in agreeing to a suitable test for measuring the caking properties of coal. British, French and Belgian scientists recently visited Holland to study the tests used there. Now a British method, the Gray King assay coke test, is being studied by Dutch and French scientists who are visiting the National Coal Board's Coal Survey Laboratory at Sheffield.

Diamond Tools

A lecture on the production and use of diamond grinding wheels will be delivered by J. C. Dawkins at the South East London Technical College, Lewisham Way, London, S.E.4, on Monday, 28 January 1952, commencing at 7 p.m. This lecture is one of a series in a course on the technology of diamonds and other hard substances.

Glass Tube Project in Scotland

A new plant at the Firhill (Glasgow) factory of Chance Brothers, Ltd.; was inaugurated on 16 January, by Mr. James Stuart, Secretary of State for Scotland, for the manufacture of glass tubes for fluorescent lighting. Although most of the original designs for the process machinery were American they have been adapted by Chance Brothers, which also designed the furnace. All the machinery was manufactured by British firms.

Sixty Years' Service

An interesting ceremony took place at Widnes Foundry & Engineering Co., Ltd., on Saturday, 5 January. Amidst a gathering of long service men (nine of them with an average service of 54 years), a cheque was presented to Mr. I. Sankey upon the anniversary of his starting at the foundry 60 years ago, by the joint managing director, Mr. R. Credland.

Electrographic Analysis

The first ordinary meeting of the Physical Methods Group of the Society of Public Analysts and Other Analytical Chemists will be held at 6.30 p.m. on Tuesday, 17 February, in the meeting room of The Chemical Society, Burlington House, W.1. The subject of the meeting will be Electrographic Analysis and the chairman will be Dr. J. Hasslem, F.R.I.C.

Mr. P. R. Monk, B.Sc., A.R.C.S., A.R.I.C., will read a paper 'Electrographic analysis—a brief survey of its developments, with special reference to recent British apparatus'. Messrs. G. C. Clark, A.R.I.C., and F. E. Hall, A.R.I.C., will be presenting a paper 'The identification of certain alloys and stainless steels by electrographic methods'.

Glasgow Hotel for I.C.I. Offices

Negotiations for the acquisition by Imperial Chemical Industries, Ltd., of the Beresford Hotel, Sauchiehall Street, Glasgow, are reported to be almost completed. It is proposed to turn the building into offices for headquarters staff. The hotel was completed in 1938 at a cost of £170,000 and an additional £23,000 was spent on furnishings.

OVERSEAS

U.S. Sulphur Restrictions

Forthcoming sulphur allocation orders in the U.S. are expected to curtail use of the element drastically. Consumers are likely to be restricted to 90 per cent of their 1950 consumption—no very great hardship to British consumers, but the first of its kind across the Atlantic. Inventory restrictions will be continued, no consumer being permitted to stock more than a 25-day supply of sulphur or sulphuric acid.

Post-graduate Training

The need to raise the level of technical experts in order to cope with the demands of a fast-expanding industry has led many engineers to follow the courses started by the Institute for Post-Graduate Training of Engineers, states the Hungarian News and Information Service.

The aim of the Institute is said to be to give a post-graduate scientific training to engineers engaged in practical work by making them acquainted with advanced Soviet science, so that they should be in a position to carry out the aims of economic planning, and to contribute to the development of the technical sciences.

In view of the under-developed nature of the Hungarian foundry industry in the past, special emphasis is placed on this industry, and the lectures are divided into metallurgical and technical branches.

Canadian Match Monopoly

Another judgment finding companies guilty of monopoly has recently been given in Canada. Five match companies were fined $85,000 in all by King's Bench for being 'parties or privies to, or knowingly assisting in the formation or operation of a merger, trust, or monopoly, which substantially or completely controlled the wooden match business in Canada, excluding Newfoundland'. Three other charges against the companies concerned have been postponed until the next term. Bryant & May, Ltd., are shown in the share registry as the principal shareholder in one of the companies, with lesser amounts held by another company and various individuals.

Manganese Recovery Difficult

A problem which has been worrying the U.S. Bureau of Mines for some time is how to exploit the manganese ore in Maine, New England, which contains only about 8-12 per cent manganese as compared with 48 per cent in the ores imported from places like India, South Africa, Gold Coast, Cuba and Mexico. The Maine ore also contains large amounts of manganese carbonates and silicates, as well as dioxide, which complicates refining methods. An economic process for the exploitation of the Maine ores may also be the key to the recovery of manganese from the steel industry's open hearth slag, as this is chemically very similar.

French Oil Refinery Extended

The plan to create a major oil refining industry in Europe was carried a stage further on 17 January when the extension to the Shell-Berre installations in the Mediterranean zone were officially opened by M. André Charon, president of Shell-Berre. When the new plant, which cost between £8,000,000 and £10,000,000, comes fully 'on stream' the 1950 output of this refinery will be nearly trebled. By the end of this year it is expected to be handling crude oil at a rate of 3,000,000 metric tons yearly, which will bring the total 'throughput' of the three refineries on l'Etang de Berre to about 7,000,000 tons. Through the contribution by Shell-Berre to her domestic requirements, France will now be able to have a small surplus of oil for export.

Plenary Session

Professor J. D. Bernal, the British scientist, was one of many foreign guests at the plenary session of the Hungarian Academy of Sciences held last month. Reporting on the Academy's work during the last year, Professor Erdei-Gruz, general secretary, said that Hungarian scientists, like Soviet scientists, realised that their task was not only to comprehend nature, but also to transform it. Hungarian scientists had discovered that the fruits of their work were now being used for the construction of socialism.

Oxygenated Organics

Study of Thermodynamic Properties

THE determination of the thermodynamic properties of oxygenated organic compounds has received little attention in contrast to the effort expended upon hydrocarbons. It was pointed out in a paper at the 44th annual meeting of the American Institute of Chemical Engineers recently that the rapid development of the synthetic chemical industry suggests that more work on oxygenated compounds would be worthwhile. The authors described the investigation they had carried out to develop an apparatus suitable for measuring the pressure/volume/temperature relations of oxygenated organic compounds. Ethylene oxide was chosen for the initial study largely because of its present and potential importance in the chemical industry.

The authors measured the volume of ethylene oxide in the vapour and saturated liquid regions in a compressibility bomb from 14.7 to 600 lb./sq. in. abs. over a temperature range of 70° to 310°F. Additional data were taken in the critical region ($t_c = 384.4$°F., $P_c = 1{,}043$ lb./sq. in. abs., $V_c = 0.051$ cu. ft./lb.). Polymerisation at temperatures above 220°F. was rapid enough to require measurements as a function of time. At 310°F. the volume decrease was 0.4 per cent per hour. Testing of the apparatus with nitrogen and *n*-butane gave results within 0.2 per cent of the accepted volumes for these substances. The inaccuracy of the ethylene oxide volumetric data is believed to be less than 0.3 per cent below 210°F. and less than 1 per cent above 310°F.

The available spectroscopic information was combined with the volume data to determine enthalpy and entropy values in the two-phase and gaseous regions. The results were shown in graphical and tubular form.

Ion-Exchange Resins

New Use as Esterification Catalyst

WORKERS at the University of Michigan have recently investigated whether the free acid form of a monosulphonated styrene polymer, a typical cation-exchange resin, could find application in a large class of acid-catalysed organic reactions.

At the 44th Annual Meeting of the A.I.Ch.E. recently, the authors pointed out that existing data, secured from batch reaction studies where reactant concentrations were not measurable, had been meagre and it had not been possible to determine the efficacy of an ion-exchange resin as an esterification catalyst instead of the usual mineral acid such as HCl. Also, they said that they felt that the results of their investigation might be able to resolve some of the wide disagreement among previous workers on the mechanism of the resin-catalysed reactions as well as on the superiority of resins over mineral acid catalysts.

Possible advantages offered by the cation-exchange resins were said to be:—

(1) A separation step is eliminated.

(2) There is no deterioration or loss of the catalyst.

(3) Undesirable side-reactions resulting from sulphuric acid are avoided.

(4) A fixed bed of high acid concentration is well adapted to continuous operation.

To provide quantitative rate information and develop suitable correlation methods in this field, the authors chose the acetic acid/ethanol esterification and used a typical cation-exchange resin as catalyst. They resolved mathematically the complex interaction of diffusion and reaction kinetics within the resin which determines overall esterification rate. Their final rate expression included a multiplier function which gave the volumetric efficiency of the resin catalyst. The latter was shown to be a function of temperature and resin bead size almost exclusively.

Obituary

Professor P. J. Drumm

The death is reported in Cork of PROFESSOR P. J. DRUMM, Ph.D., D.Sc., Professor of Biochemistry, University College, Cork, where he went in 1925 as holder of a State Research Scholarship. After a number of years as assistant, he was appointed Lecturer in Applied Chemistry in 1932, and five years ago was appointed Professor of Biochemistry. Professor Drumm contributed much to the Irish and English chemical industries. As the holder of a Rockefeller Foundation Fellowship in 1931, he studied at the Kaiser Wilhelm Institute for Medical Research at Heidelberg. During 1936-1937 he was Lecturer in Medical Chemistry at the University of Edinburgh.

Publications & Announcements

SENIOR Economisers, Ltd., have recently issued a new catalogue dealing with their three main types of economiser, all of which have the characteristic straight gas passages. The construction of each type is described and the album of photographs and drawings gives the performance under test of some 50 installations. The three economisers dealt with are the welded, twin tube and H-tube type models. The drawings are extremely detailed and comprehensive.

* * *

WESTOOL, Ltd., of St. Helen's, Auckland, Co. Durham, have issued a leaflet on their A.C. solenoids, series 700, of which there are four models, one pull type and three thrust. The publication contains details of force/stroke and other characteristic curves, and specifications of the various models.

* * *

THE Proceedings of the Indian Academy of Sciences, Nos. 4 and 5, Volume XXXIV are now available from the Academy at Bangalore. Papers cover an investigation into the chemical behaviour of sulphur compounds (H_2S and SO_2), a note on the nature of the metal-carbon bond in organo-alkali compounds, the eighth of a set of papers on the anthraquinone and anthrone series, an account of experiments on the diamagnetism of some isoelectronic compounds and others. The annual subscription to the Proceedings is 18 Rupees.

* * *

ESTERS of glycerol, glycols and polyethylene glycols are fully described in the new issue of the booklet, 'Esters by Glyco'. This 24-page brochure gives tables of physical and chemical specifications of the non-ionic polyhydric alcohol fatty acid esters. Use data are listed for such applications as surface-active agents, emulsifiers, stabilisers, defoamers, penetrants and plasticisers. Special grades of edible surface-active agents are available for use in food and pharmaceutical products. In addition to these industries, interesting applications of the esters are described in the fields of plastics, cosmetics, metals, paints, insecticides, textiles, detergents, etc.

Copies of the new issue are available, free of charge, on request from Glyco Products Co., Inc., 26 Court Street, Brooklyn 2, N.Y.

'BUILDING a Petroleum Chemicals Plant', is the title of its latest publication issued by Petrocarbon, Ltd. (printed by Gale & Polden, Ltd., London). The booklet brings together three papers on the engineering, fuel, heat and power, and chemical engineering aspects of this great project at Urmston, Manchester. The papers are: 'Some Engineering Aspects of Building a Plant for the Production of Chemicals from Petroleum', read by H. E. Charlton before the Manchester Association of Engineers; 'The Fuel, Heat and Power Aspects of the Petroleum Chemicals Plant for Petrochemicals, Ltd.', delivered to the Institute of Fuel by E. Bonwitt; and 'Chemical Engineering Aspects as Applied to the Building of a Petroleum Chemicals Plant', also by H. E. Charlton and read before the North-Western Branch of the Institution of Chemical Engineers. The papers have been supplemented by the reproduction of some striking photographs of the plant.

* * *

'ALLOY Metals Review' for December, 1951, has just been published by High Speed Alloys, Ltd. It contains an article on vanadium steels for castings and a short list of abstracts and references at the end. It is obtainable from the company at Widnes, Lancs.

* * *

VOLUME XI of the Institute of Petroleum's *Reviews of Petroleum Technology* has just made its appearance and contains a valuable and critical record of the progress made in the science and technology of petroleum during the year 1949. As in previous years, the authors have done much searching of literature to examine the material on which their reviews are based and the volume contains references to nearly 3,000 technical papers and articles. Although 1949 is the year mainly covered, there are instances where in previous years the information available has been insufficient to warrant a review covering one year only. Thus, the present volume reviews plant instrumentation for the period 1947 to 1949, crude oils for the same period, and insulating and hydraulic and bitumen for the years 1948 and 1949. It may be obtained from the Institute at Manson House, 26 Portland Place, W.1 (27s. 6d., post paid).

THE RIC has published its journal for December, 1951. It contains a tribute to the retiring Registrar, Mr. R. L. Collett, M.B.E., M.A., F.R.I.C., who has been a salaried officer of the Institute for 26 years. He has also been vice-president of the Society of Public Analysts for the last two years. Summaries of lectures in the Journal deal with industrial toxicology, lead tetraethyl in petrol, and a report of the dinner after the delivery of the Seventh Dalton Lecture by Lord McGowan, on 27 December, in Manchester. There are the usual series of book reviews and accounts of local section affairs, and a list of examination results.

* * *

'PROTECTION and Electrodeposition of Metals', is the subject of the third volume of Selected Government Research Reports, published this month by the Department of Scientific and Industrial Research (HMSO, 30s.; U.S.A., $6.75). The volume contains selected reports, mostly unpublished, on work carried out during the war by the Ministry of Supply and the Ministry of Aircraft Production. The first part of the book includes reports dealing with the protection of magnesium alloys, the protection of steel, the polishing of aluminium alloys, the study of intercrystalline attack and the operation of corrosion tests. Research into electroplating problems is dealt with in the 13 reports in the second part. The use of zinc, nickel, cobalt, aluminium and selenium for protective coverings is considered. Several reports deal with methods of determining the constituents of plating solutions, particularly traces of unwanted metals. Chemical and magnetic methods of finding the thickness of deposited coats are described and in one case details are given of adhesion tests for use during the inspection of plating.

* * *

INSTRUCTION on the care and maintenance of PVC gloves and clothing is given in a small booklet published by James North & Sons, Ltd. It is a useful source of information on the practical and legal aspects of industrial protection, and gives detailed hints for the use of protective clothing, its cleaning and maintenance. Also given is a list of references to regulations affecting various trades, and the pages of the booklet which deal with them. Copies of the publication are obtainable free from Northide, Ltd., Stockport, Cheshire.

TWO new Sunvic instruments recently developed for accurate temperature control are described in two leaflets now published. One, a resistance thermometer proportional controller, type RT.2, is for use with creep test furnaces, muffle furnaces, electric ovens, etc., and the other, a thermostatic relay type ED.2, is for use with water baths, incubators, sterilisers and the like.

* * *

MAGNESIUM, its history and development from 1852-1952, is the subject of an article in the January issue of *Research* (Vol. 5, No. 1), which has been re-oriented to have particular appeal to the industrial scientist and executive. Another article describes the usefulness to the industrial chemist of the Barker index system which may be used for the identification of crystals of over 7,000 substances.

* * *

IN COMMEMORATION of their centenary year, 1950, Negretti & Zambra have published a handsome booklet showing the evolution of the firm from the small premises Henry Negretti occupied in Old Leather Lane in 1843. Partnership with Joseph Zambra occurred in 1850, and the original premises were in Hatton Garden. Admiral Fitzroy, the famous hydrographer and meteorologist, figures prominently in the company's history. Apart from devising and constructing a double-bulb deep sea thermometer for taking temperatures at great depths that is still in use to-day, modifications designed to allow mercurial barometers to withstand concussion from ship's guns were introduced at his suggestion. Further most interesting snatches from the firm's history are shown in engravings of the Great Exhibition in 1851 and the firm's showrooms in the Crystal Palace. Optical instruments were taken up towards the end of the nineteenth century, but these were dropped after the first World War and the field restricted to industrial and aeronautical instruments. This activity has gradually expanded until the present day, when the company employ a total of 821 people. They have recently purchased a modern factory at Aylesbury of 50,000 sq. ft., with land for extension, where some time in the distant future they hope to concentrate all their production, so that their employees can live near their work and enjoy the amenities of the country.

Next Week's Events

MONDAY 28 JANUARY

Royal Institute of Chemistry

Oxford: University Physical Chemistry Laboratory, 8.15 p.m., with the Alembic Club. Dr. E. J. Bowen: 'Fluorescence Quenching'.

Institution of Rubber Industry

Manchester: Engineers' Club, Albert Square, 6.15 p.m. Miss Anne Shaw: 'The Function of Motion Study in Increasing Industrial Productivity'.

Institution of Works Managers

Manchester: Grand Hotel, 6.30 p.m. D. G. Petrie: 'Re-Equipment and Profits', examples reviewed against the background of American practice.

TUESDAY 29 JANUARY

Royal Institute of Chemistry

London: University College, Gower Street, W.C.1, 5 p.m., with the University College Chemical and Physical Society. Sir Eric Rideal: 'Catalytic Hydrogenation'.

The Chemical Society

Leeds: University, 6.30 p.m. Dr. F. Fairbrother: 'The New Elements'.

Society of Instrument Technology, Ltd.

London: Manson House, Portland Place, W.1, 6.30 p.m. Joint meeting with the Control Section. Professor A. Tustin (Birmingham University): 'Some Mechanical Considerations in the Design of Electrical Servo Systems'.

WEDNESDAY 30 JANUARY

The Chemical Society

Belfast: Queen's University, 7.15 p.m. Joint meeting with RIC and SCI. Dr. Eric Ashby: 'Recent Research on the Control of Flowering in Plants'.

Society of Public Analysts

Glasgow: 123 Sauchiehall Street, 12.30 p.m. Scottish Section, annual general meeting.

Royal Statistical Society

Birmingham: Chamber of Commerce, 95 New Street, 6.45 p.m. Industrial Applications Section. M. G. Peakmann: 'Problems of Quality Control in a Rubber Factory'.

THURSDAY 31 JANUARY

Society of Chemical Industry

London: Burlington House, Piccadilly, W.1, 6.30 p.m. Corrosion Group. Professor G. I. Finch: 'The Electron-Optical Study of Corrosion', followed by discussion.

Royal Institute of Chemistry

London: Battersea Polytechnic, S.W.11, 7 p.m., with Battersea Polytechnic Chemical Society. Dr. J. B. Gardner: 'Separation of Gases by Low Temperature Methods'.

The Chemical Society

Dundee: University College, 5.15 p.m. Professor M. J. S. Dewar: 'Some Recent Developments in Theoretical Organic Chemistry'.

Hull: University College, 6 p.m. Dr. J. H. Schulman: 'The Physics and Chemistry of Monolayers'.

Nottingham: University, 4.45 p.m., with Nottingham University Chemical Society. Dr. J. S. Anderson: 'The Place of the Transuranic Elements in the Periodic Table'.

Sheffield: University, 5.30 p.m., with Sheffield University Chemical Society. Dr. A. F. Wells: 'Some Relations between Crystal Structures'.

Society of Leather Trades' Chemists

Northampton: College of Technology, St. George's Avenue, 2.30 p.m. Dr. M. Schwank: 'Tanning with Water-Soluble Synthetic Resins'.

The Royal Society

London: Burlington House, Piccadilly, W.1, 2.30 p.m. Professor A. V. Hill will open a discussion on 'The Thermodynamics of Elasticity in Biological Tissues'.

U.S. Government Appeal Heard

THE hearing of the appeal by the U.S. Government against a ruling in 1949 that it was responsible for the disaster in Texas City on 16 April, 1947, started on 7 December. The disaster, caused by the explosion of the *S.S. Grandcamp* carrying a cargo of ammonium nitrate, killed 600, injured 3,000, and was estimated to have done material damage to the extent of £21,000,000. One of the biggest claimants against the Government was the Monsanto Chemical Company, who asked £18,000,000 damages for the destruction of its Texas City styrene plant, expenses incurred and loss of profits resulting from the plant's destruction, and loss of services of the technically trained and operating personnel who were killed in the explosion. The District Court proceedings have already filled 36 volumes.

Law & Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Increases of Capital

The following increases of capital have been announced:—SYNTHETIC CARBON & ENGINEERING CO., LTD., from £10,000 to £50,000; BRITISH ACHESON ELECTRODES, LTD., from £250,000 to £1,000,000; CHEMICAL BUILDING PRODUCTS, LTD., from £3,400 to £12,000.

New Registrations

Albion Laboratories, Ltd.

Private company. (503,230). Capital £100. Manufacturers of chemicals, gases, drugs, medicines, etc. First directors are not named. Solicitors: Frere Cholmeley & Nicholsons, 28 Lincolns Inn Fields, W.C.2.

Nuodex, Ltd.

Private company. (503,324). Capital £50,000. Industrial chemists, manufacturers, exporters and importers of chemicals and all kinds of chemical products. Directors: L. Roon, H. V. Whelan, S. F. Barham, N. Dawson, A. Robertson and R. G. W. Gallant. Solicitors: Wilkinson & Marshall, 1 Mosley Street, Newcastle-on-Tyne.

Plastic Constructions, Ltd.

Private company. (503,397). Capital £1,000. Constructors and fabricators of chemical and any other plant from plastic. Directors: J. W. Parkes and H. Aron. Reg. office: 37a Weatheroak Road, Sparkhill, Birmingham, 11.

Consumption Increased

Consumption of fertilisers has increased considerably in Cuba in the last six years. Whereas in the crop year 1944-45 only 74,860.75 short tons were used, the amount utilised in the 1950-51 crop year was 236,112.84 tons, an increase of 215 per cent. This represents an increase in the number of farms using fertilisers of from 12 per cent of the total in 1945 to 37 per cent in the 1950-51 crop year, and of from 144,983 hectares to 456,697 hectares of land using fertiliser.

Company News

Imperial Chemical Industries, Ltd.

The permission of H.M. Treasury having been obtained, the Board of Directors of Imperial Chemical Industries, Ltd., have decided to issue 10,093,023 new Ordinary shares of £1 each at the price of 40s. 6d. per share. These shares will be offered to the Ordinary Stockholders on the Company's Register of Members on 16 January 1952, in the proportion of one new Ordinary Share for each £6 of Ordinary Stock then held by the Ordinary Stockholders, fractions of new shares being disregarded. No increase in the Company's authorised capital is needed for this issue.

Both Preference and Ordinary Stockholders may apply for any balance of new Ordinary Shares ('Excess Shares') which may remain after the 'rights' of the Ordinary Stockholders have been satisfied.

The Company's circular letter offering the new Ordinary Shares to Stockholders, together with a provisional allotment letter and an application form for 'Excess Shares,' will be issued on 15 February, 1952.

The new Ordinary Shares are to be paid for by the following instalments:

On or before 7 March 1952, 20s. per share.

On or before 18 April 1952, 20s. 6d. per share.

Of each instalment, 10s. per share will be capital and the balance will be premium.

The new Ordinary Shares will not participate in any dividend which may be paid in respect of the Company's financial year ended 31 December 1951, but will otherwise carry full dividend rights as from 1 January 1952, and will rank in all other respects *pari passu* with the existing Ordinary Stock of the Company.

The new Ordinary Shares, as and when they become fully paid, will be converted into Ordinary Stock transferable in units of £1 and multiples thereof.

Arrangements were made with Messrs. Hoare and Company, Messrs. Panmure Gordon and Company, Messrs. Rowe and Pitman and Messrs. J. and A. Scrimgeour for the issue to be underwritten on usual terms.

British Chemical Prices

LONDON.—There has been rather more activity in the industrial chemicals market during the past week with a steady flow of inquiry for shipment, mainly for Empire destinations. The call for deliveries against contracts has been steady and a fair weight of new forward business has been placed.

Changes have been fewer than expected with higher prices ruling for sodium sulphite, lime acetate and copper sulphate. An advance in prices for oxalic acid and formic acid has been notified to come into operation on 1 February. The coal tar products market remains very firm with most items continuing in good request. American duty-free cresylic acid is in better demand and quotations are about 7s. 6d. to 8s. 6d. per gallon.

MANCHESTER.—Traders on the Manchester market during the past week have again experienced rather less pressure for products used in the textile and allied industries, but otherwise delivery specifications for pretty well the full range of heavy chemicals has been circulating steadily, with supplies not too readily obtainable in a number of directions. Fresh inquiry on home trade account as well as for shipment has been coming forward fairly satisfactorily. A rather substantial rise in the price of sulphate of copper has been notable among market movements. There has been an improving demand for fertilisers, including the phosphatic materials, with a steady trade passing in the tar products.

GLASGOW.—Trade during the past week has been steady but unexciting. The demand for acids and alkalis has been maintained and despite fears in certain sections of the consuming industry of a falling off in trade, manufacturers of certain acids are finding it difficult to keep up with demand. There has been a falling off in inquiries for the export market but this is believed to be fairly seasonal and not likely to have any adverse effect on trade.

General Chemicals

Acetic Acid.—Per ton : 80% technical, 1 ton, £110 ; 80% pure, 1 ton, £116 ; commercial glacial 1 ton, £130 ; delivered buyers' premises in returnable barrels ; in glass carboys, £7 ; demijohns, £11 extra.

Acetic Anhydride.—Ton lots d/d, £166 per ton.

Acetone.—Small lots : 5 gal. drums, £145 per ton ; 10 gal. drums, £135 per ton. In 40/50 gal. drums less than 1 ton, £115 per ton ; 1 to 9 tons, £114 per ton ; 10 to 49 tons, to £113 per ton ; 50 tons and over, £112 per ton.

Alcohol, Industrial Absolute.—50,000 gal. lots, d/d, 4s. 7½d. per proof gallon ; 5000 gal. lots, d/d, 4s. 8½d. per proof gal.

Alcohol, Diacetone.—Small lots : 5 gal. drums, £133 per ton ; 10 gal. drums, £128 per ton. In 40/45 gal. drums : less than 1 ton, £113 per ton ; 1 to 9 tons, £112 per ton ; 10 to 50 tons, £111 per ton ; 50 to 100 tons, £110 per ton ; 100 tons and over, £109 per ton.

Alum.—Loose lump, £17 per ton, f.o.r. MANCHESTER : Ground, £17 10s.

Aluminium Sulphate.—Ex works, £11 10s. per ton d/d. MANCHESTER : £11 10s.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Bicarbonate.—2 cwt. non-returnable drums ; 1 ton lots £47 per ton.

Ammonium Chloride. — Grey galvanising, £27 10s. per ton, in casks, ex wharf. Fine white 98%, £21 10s. to £22 10s. per ton. See also Salammoniac.

Ammonium Nitrate.—D/d, £18 to £20 per ton.

Ammonium Persulphate. — MANCHESTER : £6 2s. 6d. per cwt. d/d.

Ammonium Phosphate.—Mono- and di-, ton lots, d/d, £93 and £91 10s. per ton.

Antimony Sulphide.—Golden, d/d in 5 cwt. lots as to grade, etc., 2s. 6½d. to 3s. 7½d. per lb. Crimson, 4s. to 5s. 4½d. per lb.

Arsenic.—Per ton, £59 10s. nominal, ex store.

Barium Carbonate.—Precip., d/d ; 2-ton lots, £35 5s. per ton, bag packing.

Barium Chloride.—£44 10s. 2 ton lots d/d bags.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £41 per ton d/d ; 2-ton lots, £41 5s. per ton d/d.

Bleaching Powder.—£19 10s. per ton in casks (1 ton lots).

Borax.—Per ton for ton lots, in free 140-lb. bags, carriage paid: Anhydrous, £59 10s.; in 1-cwt. bags; commercial, granular, £38 10s.; crystal, £42; powder, £43; extra fine powder, £44; B.P., granular, £48 10s.; crystal, £51; powder, £52; extra fine powder £53.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial, granular, £68; crystal, £76; powder, £73 10s.; extra fine powder, £75 10s.; B.P., granular, £81; crystal, £88; powder, £85 10s.; extra fine powder, £87 10s.

Butyl Acetate BSS.—£263 per ton, in 10-ton lots.

Butyl Alcohol BSS.—£250 per ton, in 10-ton lots.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid £9 12s. 6d. per ton, in 4-ton lots.

Charcoal, Lump.—£26 to £28 per ton, ex wharf. Granulated, £35 to £40 per ton.

Chlorine, Liquid.—£28 10s. per ton d/d in 16/17-cwt. drums (3-drum lots).

Chrometan.—Crystals, 6d. per lb.

Chromic Acid.—1s. 11d. to 1s. 11½d. per lb., less 2½%, d/d U.K.

Citric Acid.—1 cwt. lots, 218s. cwt. 5 cwt. lots, 213s. cwt.

Cobalt Oxide.—Black, delivered, 13s. per lb.

Copper Carbonate.—MANCHESTER: 2s. 6d. per lb.

Copper Chloride.—(63%), d/d, 2s. 9d. per lb.

Copper Oxide.—Black, powdered, about 1s. 4½d. per lb.

Copper Nitrate.—(63%), d/d, 2s. 8d. per lb.

Copper Sulphate.—£107 17s. 6d. per ton f.o.b., less 2%, in 2-cwt. bags.

Cream of Tartar.—100%, per cwt., about £12 12s. d/d.

Ethyl Acetate.—10 tons and upwards, d/d, £174 per ton.

Formaldehyde.—£33 15s. per ton in casks, according to quantity, d/d.

Formic Acid.—85%, £80 15s. 4 ton lots, carriage paid.

Glycerine.—Chemically pure, double distilled 1,260 s.g. £14 9s. 0d. per cwt.
Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 3d. to 2s. 6d. per lb.; bulk carriage paid.

Hydrochloric Acid.—Spot, 9s. 6d. to 10s. 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Hydrogen Peroxide.—27.5% wt. £124 10s. per ton. 35% wt. £156 per ton d/d. Carboys extra and returnable.

Iodine.—Resublimed B.P., 21s. 3d. per lb. in cwt. lots.

Iodoform.—25s. 4d. per lb. in cwt. lots.

Iron Sulphate.—f.o.r. works, £3 15s. to £4 5s. per ton. Bags free.

Lactic Acid.—Pale tech., 44 per cent by weight £130 per ton; dark tech., 44 per cent by weight £100 per ton ex works; Usual container terms.

Lead Acetate.—White: £194 10s. per ton.

Lead Carbonate.—Nominal.

Lead Nitrate.—£161 10s. per ton.

Lead, Red.—Basis prices per ton: Genuine dry red lead, £194; orange lead, £206. Ground in oil: red, £216; orange, £228.

Lead, White.—Basis prices: Dry English, in 8-cwt. casks, £200 10s. per ton. Ground in oil: English, under 2 tons, £217 10s.

Lime Acetate.—Brown, ton lots, d/d, £18 to £20 per ton; grey, 80-82%, ton lots, d/d, £22 to £25 per ton.

Litharge.—£194 per ton.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £27.

Magnesium Carbonate.—Light, commercial, d/d, £87 15s.; cwt. lots £97 10s. per ton d/d.

Magnesium Chloride.—Solid (ex wharf), £15 per ton.

Magnesium Oxide.—Light, commercial, d/d, £221; cwt. lots £227 10s. per ton d/d.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—Per lb., lump, 10s. 8d.; smaller quantities dearer.

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

Methanol.—Pure synthetic, d/d, £28 to £38 per ton.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 7s. 10d. per gal. ; pyridinised 64° O.P. 100 gal., 7s. 11½d. per gal.

Nickel Sulphate.—Deld. buyers U.K. £140 10s. per ton.

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—About £179 10s. per ton, packed in 5-cwt. lots, packed in free 5-cwt. casks.

Paraffin Wax.—Minimum 1-ton lots £76 5s. ; smaller quantities £77.

Phosphoric Acid.—Technical (S.G. 1.500), ton lots, carriage paid, £71 10s. per ton ; B.P. (S.G. 1.750), ton lots, carriage paid, 1s. 3½d. per lb.

Potash, Caustic.—Solid, £198 10s. per ton for 1-ton lots ; Liquid, £37 15s.

Potassium Bichromate.—Crystals and granular, 11⅛d. per lb. ; ground, 10⅝d. per lb., standard quantities.

Potassium Carbonate.—Calcined, 98/100%, £88 10s. per ton for 1-ton lots, ex store ; hydrated, £81 for 1-ton lots.

Potassium Chlorate.—Imported powder and crystals, nominal.

Potassium Chloride.—Industrial, 96%, 6-ton lots, £16 10s. per ton.

Potassium Iodide.—B.P., 18s. 7d. per lb. in 28 lb. lots.

Potassium Nitrate.—Small granular crystals, 81s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 7½d. per lb. for 1-cwt. lots ; for 3 cwt. and upwards, 1s. 6½d. per lb. ; technical, £8 3s. per cwt. ; for 5 cwt. lots.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—Dog-tooth crystals, £72 10s. per ton ; medium, £67 10s. per ton ; fine white crystals, £21 10s. to £22 10s. per ton, in casks.

Salicylic Acid. — MANCHESTER : Technical 2s. 7d. to 2s. 10d. per lb. d/d.

Soda Ash.—58% ex depôt or d/d, London station, £8 17s. 3d. to £10 14s. 6d. per ton.

Soda, Caustic.—Solid 76/77% ; spot, £21 12s. 6d. per ton d/d. (4 ton lots).

Sodium Acetate.—£85 to £91 per ton d/d.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 9d. per lb. ; anhydrous, 9¼d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite.—Powder, 60/62%, £40 per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2-cwt. free bags.

Sodium Chlorate.—£87 to £95 per ton.

Sodium Cyanide.—100% basis, 8d. to 9d. per lb.

Sodium Fluoride.—D/d, £4 10s. per cwt.

Sodium Hyposulphite.—Pea crystals £28 a ton ; commercial, 1-ton lots, £26 per ton carriage paid.

Sodium Iodide.—B.P., 20s. 1d. per lb., in 28 lb. lots.

Sodium Metaphosphate (Calgon).—Flaked, loose in metal drums, £123 ton.

Sodium Metasilicate.—£21 5s. per ton, d/d U.K. in ton lots.

Sodium Nitrate.—Chilean Industrial, 97-98%, 6-ton lots, d/d station, £30 10s. per ton.

Sodium Nitrite.—£31 for 1 ton lots.

Sodium Percarbonate.—12½% available oxygen, £8 6s. 6d. per cwt. in 1-cwt. drums.

Sodium Phosphate.—Per ton d/d for ton lots : Di-sodium, crystalline, £37 10s., anhydrous, £78 10s. ; tri-sodium, crystalline, £39 10s., anhydrous, £75 10s.

Sodium Prussiate.—10d. to 10½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Silicofluoride.—Ex store, nominal.

Sodium Sulphate (Glauber Salt).—£8 per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. £6 per ton d/d station in bulk. MANCHESTER : £6 10s. per ton d/d station.

Sodium Sulphide.—Solid, 60/62%, spot. £29 10s. per ton, d/d, in drums ; broken, £30 5s. per ton, d/d, in drums.

Sodium Sulphite.—Anhydrous, £59 per ton ; pea crystals, £37 12s. 6d. per ton d/d station in kegs ; commercial, £23 7s. 6d. per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £25 18s. 6d. to £28 8s. according to fineness.

Tartaric Acid.—Per cwt. : 10 cwt. or more, £15 10s.

Tin Oxide.—1-cwt. lots d/d £25 10s. (Nominal.)

Titanium Oxide.—Comm., ton lots, d/d (56-lb./112 lb. bags), £125 per ton.

Zinc Oxide.—Maximum price per ton for 2-ton lots, d/d ; white seal, £207 10s. ; green seal, £206 10s. ; red seal, £205.

Zinc Sulphate.—Nominal.

Rubber Chemicals

Antimony Sulphide.—Golden, 2s. 6½d. to 3s. 7½d. per lb. Crimson, 4s. to 5s. 4½d. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Off colour, ex store. Imported £13 10s per ton. Extra white bleached ex store, £16 10s.

Cadmium Sulphide.—About 20s. per lb.

Carbon Bisulphide.—£65 5s. per ton, according to quality.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£69 10s. per ton.

Chromium Oxide.—Green, 2s. per lb.

India-rubber Substitutes.—White, 1s. 9½d. to 2s. 3d. per lb. ; dark, 1s. 8½d. to 2s. 1½d. per lb.

Lithopone.—30%, £77 per ton.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, 'Rupron.'—£20 per ton.

Sulphur Chloride.—British 48s. 6d. per cwt.; Imported £120 per ton.

Vegetable Lamp Black.—£49 per ton.

Vermilion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Nitrogen Fertilisers

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, £15 12s.

Compound Fertilisers.—Per ton in 6 ton lots, d/d farmer's nearest station, I.C.I. Special No. 1, £26 9s. 6d.

'Nitro-Chalk.'—£12 9s. 6d. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean agricultural for 6-ton lots d/d nearest station, £30 10s. per ton.

Coal-Tar Products

Benzol.—Per gal, ex works : 90's, 3s. 8½d. ; pure, 3s. 11½d. ; nitration grade, 4s. 2½d.

Carbolic Acid.—Crystals, 1s. 6d. to 1s. 8d. per lb. Crude, 60's, 8s. MANCHESTER : Crystals, 1s. 6½d. to 1s. 8d. per lb., d/d crude, 5s. 9d., naked, at works.

Creosote.—Home trade, 10d. to 1s. 2d. per gal., according to quality, f.o.r. maker's works. MANCHESTER : 9½d. to 1s. per gal.

Cresylic Acid.—Pale 98%, 5s. 8d. per gal. ; 99.5/100%, 5s. 10d. American, duty free, for export, 10s. naked at works.

Naphtha.—Solvent, 90/160°, 4s. 2½d. per gal. for 1000-gal. lots ; heavy, 90/190°, 3s. 8d. per gal. for 1000-gal. lots, d/d. Drums extra : higher prices for smaller lots.

Naphthalene.—Crude, ton lots, in sellers' bags, £18 16s. 3d. to £34 per ton according to m.p. ; hot-pressed, £50 to £60 per ton, in bulk ex works ; purified crystals, £68 10s. to £79 3s. 4d. per ton.

Pitch.—Medium, soft, home trade, 130s. per ton f.o.r. suppliers' works ; export trade, 200s. per ton f.o.b. suppliers' port. MANCHESTER : £6 10s. f.o.r.

Pyridine.—90/160°, 35s. per gal. MANCHESTER : 35s. to 40s. per gal.

Toluol.—Pure, 4s. 7½d. per gal. MANCHESTER : Pure, 4s. 7½d. per gal. naked.

Xylol.—For 1000-gal. lots, 5s. 1½d. per gal., according to grade, d/d.

Wood Distillation Products

Calcium Acetate.—Brown, £15 per ton ; grey, £22.

Methyl Acetone.—40/50%, £56 to £60 per ton.

Wood Creosote.—Unrefined, from 3s. 6d. per gal., according to boiling range.

Wood Naphtha.—Miscible, 4s. 6d. to 5s. 6d. per gal. ; solvent, 5s. 6d. to 6s. 6d. per gal.

Wood Tar.—£6 to £10 per ton.

Intermediate and Dyes (Prices Nominal)

***m*-Cresol** 98/100%.—3s. 9d. per lb. d/d.

***o*-Cresol** 30/31° C.—1s. 4d. per lb. d/d.

***p*-Cresol** 34/35° C.—3s. 9d. per lb. d/d.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb. ; 66/68° C., 1s.

***p*-Nitraniline.**—2s. 11d. per lb.

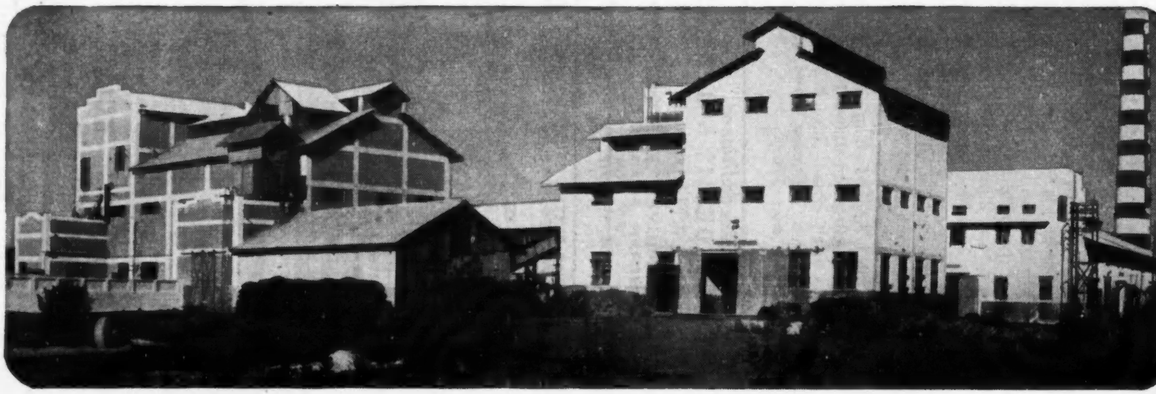
Nitrobenzene.—Spot, 5½d. per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyers' works.

Nitronaphthalene.—1s. 2d. per lb. ; P.G. 1s. 0½d. per lb.

***o*-Toluidine.**—1s. per lb., in 8/10-cwt. drums, drums extra.

***p*-Toluidine.**—2s. 2d. per lb., in casks.

***m*-Xylidine Acetate.**—4s. 5d. per lb., 100%.



Chemical & Allied Stocks & Shares

A DOWNTREND in industrial share prices has been the main feature in stock markets where sellers predominated and buyers have been cautious, awaiting news of the Government's next moves to check inflation and to stop the drain on gold and dollar reserves. Contrasting with the decline in industrials, British Funds were inclined to strengthen. Big new issue news has affected the industrial sections, because investors have sold shares to provide money to take up new shares on attractive terms.

Imperial Chemical have receded to 41s. 6d. at the time of writing, following the company's decision to offer shareholders over 10,000,000 additional shares at 40s. 6d. each in the proportion of one for every six held, which will bring in nearly £20,500,000. Financing of stocks, the group's expansion plans, and rearmament and allied activities, are no doubt factors explaining the need for new money. The new shares will not rank for dividend for the past year, but the market believes there are good prospects of the 12 per cent dividend being maintained and also of this rate being held for the current year on the larger capital. It is pointed out in the City that the decision to make a big share issue rather than a private placing of loan stock as was done by I.C.I. in 1950, indicates confidence in the outlook. At their current price of 41s. 6d. Imperial Chemical ordinary yield 5¼ per cent, which is a generous return.

Chemical shares generally have moved back with the prevailing trend in markets. Fisons were back to 29s. 9d.; and despite the sharp increase in the rate of profits indicated by the company's statement for the ten months to October last, Monsanto 5s. shares were lower at 27s. Eaglescliffe 5s. shares were 17s. 9d., Laporte 5s. units 10s. 3d., and William Blythe 3s. shares 11s. 10½d., while Albright and Wilson have changed hands around 16s. Amber Chemical 2s. shares were 2s. 6d., Brotherton 24s. and Hardman and Holden 5s. shares were quoted at 25s. Shares of companies identified with plastics have moved back with the general trend, but attracted buyers. British Industrial Plastics 2s. shares at 5s. 10½d. continued to be helped by the financial results. Kleemann were 9s. 3d. and British Xylonite 29s. In other directions, British Glues 4s. shares were 12s. 6d. Lever and Unilever were 47s. 3d. at which there is a yield of over 5¼ per cent on the basis of last year's 13½ per cent dividend. Borax Consolidated at 33s. 9d. were more active. United Molasses were back at 34s. 3d., the 4s. units of the Distillers Co. 19s. 1½d., while Turner and Newall came back to 86s. Boots Drug were 21s. 3d., Sangers 16s. 9d. and elsewhere Triplex Glass were 24s. 6d. Powell Duffryn at 30s. also came back with the general trend, as did Associated Cement at 100s. and Goodlass Wall at 19s. 3d. Among oils, Anglo-Iranian at £5¼ have firmed up on attention drawn to the growing oil output from Iraq. Shell were 93s. 1½d., while Ultramar have been an active feature over 37s.

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

A FIRST CLASS CHEMICAL ENGINEER is required to fill a responsible position in the technical department in a firm of manufacturing chemists. The position offers a progressive, secure career and generous remuneration to the right man, but only persons of ability and initiative should apply. Write in strict confidence, giving full details of qualifications and experience to **Box No. C.A. 3089, THE CHEMICAL AGE,** 154, Fleet Street, London, E.C.4.

CHEMICAL ENGINEER. THE MIDLAND TAR DISTILLERS LTD., OLDBURY, near Birmingham, require a fully qualified chemical engineer with several years experience in industry. An ability to apply sound knowledge and experience to the design and development of new chemical projects is of the first importance. Age 27-35. Good salary offered according to age and experience etc. Contributory pensions scheme in operation. Applications, with full particulars, to **PERSONNEL MANAGER.**

GELATIN.—Wanted at once **CHEMIST** with works experience in the production of glue and gelatin. Apply by letter, stating experience to: LIVERPOOL CENTRAL OIL COMPANY, LIMITED, Oriel Street, Liverpool, 3.

LABORATORY ASSISTANT required for **MASTIC ASPHALT** Works in East London. Must have had similar experience. Easy hours and Pension Scheme. Apply **BOX NO. C.A.3086, THE CHEMICAL AGE,** 154, Fleet Street, London, E.C.4.

LONDON BRICK COMPANY, LIMITED, invites applications to fill two vacancies in its Technical and Research Department, located near Bedford.

(1) A Senior Staff Post in charge of fundamental studies of materials and processes used in the production of heavy clay goods.
Studies include the effect of mineral composition on the properties of clays and their processing, the heat-treatment of clays, work on the flow of gases at temperature, and other problems of heat transfer to clay goods.
Applicants should be Honours University Graduates with good research experience.

(2) A Staff position, for which the applicant should preferably hold a University Degree or the equivalent, and must have experience of brick kiln operation.

The salaries for both positions will be commensurate with the applicant's qualifications and experience.
A house will be available for the successful applicant for the senior position.
Apply, giving full particulars of qualifications and experience, to **LONDON BRICK COMPANY, LTD., AFRICA HOUSE, KINGSWAY, LONDON, W.C.2.**

PRODUCTION MANAGER

BAYER PRODUCTS LTD. requires a Manager with top grade administrative ability for its factory in the London area. The successful applicant will be responsible for all pharmaceutical production, and should have considerable experience in the manufacture of injection solutions, tablets, and other pharmaceutical preparations, as also have a background of chemical engineering. A good salary and excellent prospects are offered for the right man. Applications in confidence, with full details of previous experience and salary required to the **Managing Director, Bayer Products, Ltd., Africa House, Kingsway, London, W.C.2.**

SITUATIONS VACANT

OVERSEAS EMPLOYMENT. Analytical Chemist, holding B.Sc. in Chemistry or A.R.I.C., required by Mufulira Copper Mines, Limited, Northern Rhodesia. Starting salary, £720 per annum (£600 if without previous experience), plus cost-of-living allowance, at present £100 per annum, and bonus, at present 62 per cent on basic salary. Write, **MINE EMPLOYMENT DEPARTMENT, SELECTION TRUST BUILDING, MASON'S AVENUE, LONDON, E.C.2.**

SENIOR SCIENTIFIC OFFICERS; SCIENTIFIC OFFICERS; PATENT EXAMINER AND PATENT OFFICER CLASSES. The Civil Service Commissioners invite applications for permanent appointments to be filled by competitive interview during 1952. Interviews will continue throughout the year, but a closing date for the receipt of applications earlier than December, 1952, may eventually be announced. Successful candidates may be appointed immediately. The scientific posts are in various Government Departments and cover a wide range of scientific research and development in most of the major fields of fundamental and applied science. The patent posts are in the Patent Office (Board of Trade), Admiralty and Ministry of Supply.

Candidates must have obtained a University Degree with first- or second-class honours in an appropriate scientific subject (including engineering) or in mathematics, or an equivalent qualification, or for scientific posts, possess high professional attainments. Candidates for Senior Scientific Officer posts must, in addition, have held at least three years' post-graduate or other approved experience. Candidates for Scientific Officer and patent posts taking their Degrees in 1952, may be admitted to compete before the result of their Degree examination is known.

AGE LIMITS: Senior Scientific Officers, at least 26 and under 31; for Scientific Officers and Patent Classes, at least 21 and under 28 during 1952 (or under 31 for permanent members of the Experimental Officer class competing as Scientific Officers). London salary scales: Senior Scientific Officers (men) £750-£950; (women) £625-£850; Scientific Officers (men), £400-£650; (women), £400-£525; Patent Examiner and Patent Officer classes (men), £400-£600; (rates for women under review). Somewhat lower rates in provinces.

Further particulars from the **CIVIL SERVICE COMMISSION, SCIENTIFIC BRANCH, TRINIDAD HOUSE, OLD BURLINGTON STREET, LONDON, W.1,** quoting No. S.53/52 for Senior Scientific Officers and S.52/52-S.128/52 for the other posts.
14435/250/WP.

TWO TECHNICAL ASSISTANTS required for gas works and coal tar by-product plant design. Practical plant construction and operation an advantage. Age 25-30. Salary £500 minimum; permanent position; pension scheme; canteen. Write, stating experience to **CHEMICAL ENGINEERING WILTONS, LTD., HOLBROOK, PARK, HORSHAM.**

FOR SALE

CHARCOAL, ANIMAL AND VEGETABLE, horticultural, burning, filtering, disinfecting, medicinal-insulating; also lumps ground and granulated; established 1830; contractors to H.M. Government.—THOS. **HILL-JONES, LTD., "INVICTA" MILLS, BOW COMMON LANE, LONDON, E. TELEGRAMS: "HILL-JONES, BOCHURCH, LONDON," TELPHONE 3285 EAST.**

FOR SALE

VARIOUS MIXERS FOR SALE

FOURTEEN various open-top **STORAGE TANKS,** riveted, capacities from 300 gallons to 9,800 gallons. Last used for oil or varnish.

1½, 2½ and 3½ size belt-driven **DISINTEGRATORS** by Christy & Norris or Harrison Carter.

Size No. 3 Junior Hammamac **HAMMER MILL** with fan and cyclone, also No. 1 size Miracle **GRINDING MILLS.**

Robinson 3-sheet No. 1 size **CENTRIFUGAL DRESSING MACHINE** for dry powders, etc.

Four **ROTARY BOWL MIXERS,** 5 ft. diam., cast iron built, inclined agitators, by Baker Perkins.

Kek **GRINDING MILL,** square pin type, with grinding discs 13 in. diam., including circular delivery bin with single outlet.

Large unjacketed **WERNER MIXER,** belt and gear driven, hand tipping, double " Z " arms, pans 53 in by 45 in by 36 in. deep.

No. 200 One nearly new **WERNER PFLEIDERER JACKETED MIXER OR INCOPORATOR.** Low type, with C.I. built mixing chamber, 28 in. by 29 in. by 27 in. deep, with double " U "-shaped bottom which is jacketed, and double fish-tail or fin-type agitators geared together at one side, with belt-driven friction pulleys, 34 in. diam. by 5 in. face, with hand-wheel operation and hand-operated screw tilting gear. Machine fitted with machine-cut gears, covers, gear guard, cast-iron baseplate, and measuring overall approximately 7 ft. by 6 ft. by 4 ft. high to the to of the tipping screw.

No. 209 One **HORIZONTAL " U "-SHAPED MIXER,** steel built, riveted, measuring about 8 ft. 3 in. long by 3 ft. wide by 3 ft. 3 in. deep, with horizontal shaft, fitted with bolted-on mixing arms about 18 in. long by 4 in. wide, with intermediate breakers, and driven at one end by a pair of spur gears, with countershaft, fast and loose belt pulleys, outer bearing and plug cock type outlet at the opposite end, mounted on two cradles fitted to two R.S.J. running from end to end.

Two **FILTER PRESSES,** each fitted 68 wood recessed plates, 2 ft. 6 in. square, centre fed, with enclosed bottom corner delivery, cloth clips and belongings.

One **DEHNE FILTER PRESS,** cast iron built, fitted 45 recessed ribbed plates, 2 ft. 8 in. by 2 ft. 8 in. by 1⅜ in., with bottom corner feed, cloth clips and bottom corner separate outlets, angle lever closing gear, etc.

SIMON HORIZONTAL TUBULAR STEAM HEATED DRIER, barrel with steam-heated tubes, 12 ft. long by 5 ft. diameter.

Further details and prices upon application

Write **RICHARD SIZER LIMITED, ENGINEERS, CUBER WORKS HULL**

GRAVITY ROLLER CONVEYOR—8 lengths, 8 ft. long rolls 2½ in. diam. by 18 in. £4 10s. per length. **THOMPSON & SON (MILLWALL), LIMITED, Cuba Street Millwall E.14. Tel.: East 1844.**

HARDWOOD CHARCOAL, granulated, all sizes from 1 in. to 300 gauge powder offered for immediate or future delivery. State exact requirements. **BOX 766, SMITHS' 100, FLEET STREET, E.C.4.**

FOR SALE

600

STRIP **PICKLING AND WASHING PLANT,** comprising 33 ft. centres by 16½ in. Acid-resisting Horizontal Link **CONVEYOR,** motorised 400/3/50; lead-lined **PICKLING CHAMBER,** 5 ft. long by 2 ft. by 2 ft., with four 1-in. spray pipes supplied from totally enclosed lead-lined **TANK** 7 ft. 6 in. by 2 ft. by 2 ft.; armoured Vitreon **ACID PUMP,** motorised; **WASHING CHAMBER,** 21 ft. long with totally enclosed **LEAD LINED TANK,** 6 ft. by 2 ft. by 2 ft.

2—Vertical **GAS COOLERS,** each approx. 12 ft. diam. by 55 ft. high, constructed 12 mm. plate, tile lined and part filled ceramic rings, with water spray diffusers and all fittings, including cool water pumps. Capacity of each Cooler, 29,000 M³/hour (1,020,000 cu. ft. per hour), cooling from 220° to 20° C.

3—**AIR FANS** by Carl Encke & Co., type VL6. Capacity, 15,000 M³/hour (530,000 cu. ft. per hour), end pressure 1.1. atm. (16 p.s.i.), 1,000 mm. (40 in.) water column, 500 mm. (20 in.) i.d. suction, 400 mm. (16 in.) i.d. pressure. Approximately 80kW. (100 h.p.) required to drive.

2—**FANS** by Benno Schilde. Capacity, 29,500 M³/hour (1,040,000 cu. ft. per hour), 1000 mm. (40 in.) water column, for gas 220°C. Approximately 150kW. (200 h.p.) required to drive.

2—39 in. Oscillating **HYDRO EXTRACTORS,** with rubber-covered baskets, 39 in. by 16½ in. deep. 3-point suspension, 4 in. outlet in Monitor. Mortorised 400/3/50.

3—Recessed Plate-type **FILTER PRESSES** by Manlove Alliott, with 60 plates 24 in. sq., 1 in. thick. Hand-operated ratchet and pinion closing gear.

GEORGE COHEN SONS & CO., LTD.
SUNBEAM ROAD, LONDON, N.W.10.
Tel.: Elgar 7222 and
STANNINGLEY, NR. LEEDS.
Tel.: Pudsey 2241

PHONE 98 STAINES

DUPLEX " Z " blade **TIPPING MIXERS,** 43 in. by 40 in. by 28 in., 29 in. by 28 in. by 22 in., and 16 in. by 16 in. by 14 in.

" Gardner " **MIXER,** 5 ft. 6 in. by 2 ft. 4 in. by 2 ft. with heavy ribbon blades.

FILM DRYERS or **COOLING ROLLS,** 9 ft. by 4 ft. diam.

Stainless Steel Gas-heated Jacketed **MIXER,** 36 in. by 22 in. diam.

30-in. Electric Underdriven **HYDROS,** 400/3/50.

DISINTEGRATORS, 24 in., 22 in., 18 in., and 12 in. diam. chambers.

Jacketed **AUTOCLAVES,** 5 ft. by 4 ft. diam. and 5 ft. by 2 ft. 6 in.

Rectangular, Cyl. and Sec. **TANKS** up to 10,000 galls.

HARRY H. GARDAM & CO., LTD., STAINES

ROTARY DRYER, 40 ft. by 6 ft. diam. Maker' Wm. Johnson, driven by 24 H.P. slip-ring motor, 400 volts, 3 phase, 50 cycles, with motor-driven suction fan. Nearly new condition. Box No. C.A. 3100, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

STAINLESS steel 600 gallon **TANK.**
Monel-Metal 100 gallon water jacketed **PAN** with propellor mixer.
Steam jacketed (50 lb. p.s.i.) glanded ribbon agitator, self-discharge " U " **MIXER,** 45 gallons.
DRUM MIXER, 6 ft. dia. by 2 ft. 10 in. wide of heavy construction.
CHANGE PAN MIXERS 25 and 8 gallons.
Baker-Perkins 100 gallon double " Z " **TIPPING MIXER.**
Morton Duplex " Z " **MIXER,** 14 in. by 14 in. by 12 in., two speeds, self-motorised A.C.
80 qt. Hobart three-speed **ELECTRIC MIXER.**
WINKWORTH MACHINERY LTD., 65, HIGH STREET, STAINES. Tel.: 1010.

FOR SALE

SCREENLESS PULVERIZERS for fine grinding of Chemicals. Also **CYCLONES, ROTARY VALVE FEEDERS.** Callow (Engrs.) Ltd. Kirkby Trading Est. Liverpool.

SUBSTANTIAL QUANTITY PURE ZINC RESIDUE 80%. Enquiries invited from Consumer Works only. Apply **BOX No. C.A. 3094, THE CHEMICAL AGE,** 154, Fleet Street, London, E.C.4.

UNUSUAL OPPORTUNITY. 1 NEW STAINLESS STEEL "Z" MIXER, 132 galls., size 16. Twin blades in double trough with independent electric-operated tilting equipment. 1 only for immediate delivery. Box No. C.A. 3099, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

VERTICAL CROSSTUBE STEAM BOILER, 8½ ft. by 3½ ft. Ditto 7 ft. by 3 ft. Both 80 lb. pressure. 25-gal. Copper-lined **C.I. JACKETED PAN,** on three legs. Electric Wall-type **VENTILATING FANS,** 24 in. diam., 400/3/50; 36 in. diam., 230/1/50 and 30 in. diam., 200/1/50. **KIMMINS & SONS, LTD., LYNDHURST ROAD, WORTHING.**

1 Barron **"D" MIXER, TROUGH** 30 in. by 18 in. by 18 in. Vee-belt drive to 2 H.P. motor, 750 revs., 400/3/50. As new.

One Werner Type **MIXER, TROUGH** 36 in. by 30 in. by 28 in. Twin "Z"-blades, power tilted, fast and loose pulley drive.

THOMPSON & SON (MILLWALL) LIMITED, CUBA STREET, MILLWALL, E.14 (Tel.: East 1844)

SERVICING

ALL CHEMICALS AND DYESTUFFS can be repacked for export by **The East London Chemical Warehouse Co., Buxton Street, Stepney, London, E.1.**

CRUSHING, GRINDING, MIXING and DRYING for the trade.
THE CRACK PULVERISING MILLS, LTD.,
Plantation House,
Mincing Lane,
London, E.C.3.

GLASSBLOWING by **HALL DRYSDALE & CO. LTD., 58, COMMERCE ROAD, LONDON, N.22.** (Telephone: BOWes Park 7221.)

GRINDING of every description of chemical and other materials for the trade with improved mills. **THOS. HILL-JONES, LTD., "INVICTA" MILLS, BOW COMMON LANE, LONDON, E. TELEGRAMS: "HILL-JONES, BOCHURCH, LONDON," TELEPHONE: 3285 EAST.**

HIGH VACUUM. DOHMS have large **HIGH VACUUM PLANTS** for contract work. **DOHM, LTD., 167, VICTORIA STREET, S.W.1.**

PATENTS & TRADE MARKS

KING'S PATENT AGENCY, LTD. (B. T. King, A.M.I.Mech.E., Patent Agent), 146a, Queen Victoria Street, London, E.C.4. ADVICE Handbook, and Consultation free. Phone: City 6161.

WANTED

CYLINDERS B.S.407 suitable for refilling with "Arcton 6" required; forward details, capacity, etc., to Box C.A. 3101, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

6 STEAM JACKETED ROTARY OR TROUGHED DRIERS, approx. 20 ft. long by 5 ft. diam., with internal stirring gear, suitable for vacuum. **BOX No. C.A. 3098, THE CHEMICAL AGE,** 154, Fleet Street London, E.C.4.

WORKING NOTICES

IT IS DESIRED to secure the full commercial development in the United Kingdom of **BRITISH PATENT No. 613,850,** which relates to **"MANUFACTURE OF WATERDISPERSIBLE CHEMICAL PRODUCTS CAPABLE OF IMPARTING HYDROPHOBIC PROPERTIES TO TEXTILE FIBRES,"** either by way of the grant of licences or otherwise on terms acceptable to the Patentee. Interested parties desiring copies of the patent specifications should apply to: **STEVENS, LANGNER, PARRY & ROLLINSON, 5 to 9, QUALITY COURT, CHANCERY LANE, LONDON, W.C.2.**

IT IS DESIRED to secure the full commercial development in the United Kingdom of **BRITISH PATENT No. 613,506** which relates to **"SHAPING SHEETS OF POLYMERISED UNSATURATED ESTERS OF POLYBASIC ACIDS,"** either by way of the grant of licences or otherwise on terms acceptable to the Patentee. Interested parties desiring copies of the patent specifications should apply to **STEVENS, LANGNER, PARRY & ROLLINSON, 5 to 9, QUALITY COURT, CHANCERY LANE, LONDON, W.C.2.**

Printed in Great Britain by THE PRESS AT COOMBELANDS Ltd., Addlestone, and published by BENN BROTHERS LTD., at Bouverie House, 154, Fleet Street, E.C.4, 26 January, 1952. Registered at the General Post Office. Entered as Second Class Matter at the New York, U.S.A., Post Office.